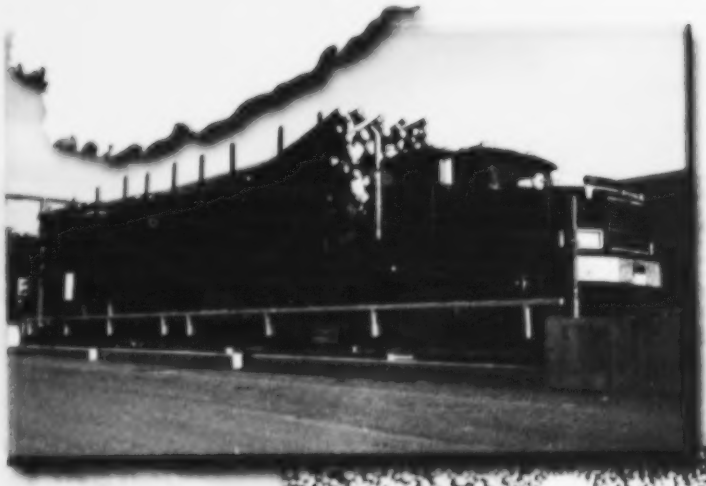
NEW BRUNSWICK SCALING MANUAL

3RD EDITION



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New Brunswick Scaling Manual

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Acknowledgement

The Minister of Natural Resources and Energy gratefully acknowledges the use of various diagrams from the Canadian Standards Association publication "Grading Roundwood", (CAN – 0302 H-00).

Definitions

Act	means the Scaling Act;
Board	means the Board of Governors appointed under the Scaling Act;
cull	means any primary forest product equal to or smaller than the 5.45 m class;
check scaler	means a scale used as a standard for comparing the results of scales for the purposes of maintaining a uniform level of scaling practices and providing a reasonable means of control over human error associated with scaling;
check scaler	means a DNRE employee designated to perform check scales;
contract	means a contract entered into between a Producer Association and a forest industry with respect to the purchase of primary forest products;
Crown lands	means all or any part of the lands vested in the Crown that are under the administration and control of the Minister and includes any water upon or under the surface of such lands;
Department	means the Department of Natural Resources and Energy;
foreign material	means any material extraneous to primary forest products such as earth, ice, snow and branches, any of which are mixed in a load of primary forest products;
harvest	means the holder of a Crown timber licence and includes his holders, executors, administrators, successors, heirs and assigns;
marketing	means buying, selling or offering for sale, and includes advertising, financing, assembling, storing, packing, shipping and transporting in any manner;
mass	means the property of a body that is a measure of its inertia and that is commonly taken as a measure of the amount of material that it contains and that causes it a force weight in a gravitational field;
Minister	means the Minister of Natural Resources and Energy;

primary forest products	means any of the commercially valuable raw material obtained from a forest, including roundwood;
Producer Associations	includes marketing boards, co-operatives and other associations established for the marketing of primary forest products;
regulation	means the General Regulation – Scalers Act;
scaling	means to measure primary forest products;
scaler	means any person licensed by the Minister to scale primary forest products;
treelength	means a felled merchantable tree that has been processed to remove limbs and top;
wood processing facility	means a mill in which primary forest products are manufactured into secondary wood products.

Introduction

This manual has been developed as a "field reference", for use by *Scalers* in the Province of New Brunswick. The content is based on legal requirements as set forth in the *Scaling Act, Chapter S-4.1* and the *General Regulation - Scaling Act 83-190*, as well as current procedural directives from NB DNRE. The province also participates and cooperates with CSA International and promotes conformance to CSA Standard 0302.1-00/0302.2-00.

Any legislative changes or DNRE procedural directives dated after this printing will override procedures in this manual. Scalers are advised to reference the current *Scalers Act* and Regulation, as required. Scalers may consult with DNRE Regional Inspectors or the Provincial Chief Scaler, with respect to any procedural changes. Future editions of this manual will incorporate relevant legislative and procedural changes.

Accurate scaling of *primary forest products* is of utmost importance. A scalers measurements directly impact on fair procurement and payment for primary forest products. This extends to all parties involved in the transaction including woods workers, landowners, forestry operators, producer associations and forest product industries. Scaling information is also used extensively for historical reference and forest management planning including wood supply analysis.

Scalers must ensure correct measure for all "*without fear, favor or affection*".

1. Scaler Licensing, Responsibilities and Accountability

1.1 Proficiency Requirements

Scaler License candidates must be at least nineteen years of age and have two years of experience assisting in scaling of primary forest products *or* be a graduate of a recognized forest technical program.

Each candidate must submit a completed application form to DNRE prior to a Scaling Examination indicating the type of license applied for, their experience in scaling, and references attesting to their integrity and experience. Application forms are available at local DNRE offices.

Candidates are required to pass examinations set by a Board of Examiners appointed by the Lieutenant Governor in Council under the authority of the Scalers Act.

1.2 Scalers Examination

Provincial Scaling Examinations are scheduled at least once annually. Local DNRE offices may be contacted for information regarding specific dates and locations of upcoming examinations.

Application may be made to write a single component, or all components of the exam, specific to the types of scaling, recognized under the *Act*. A species test is also required for all types of scaler licensing other than "stacked measure".

1.3 Scaler Licensing

Upon completion of any component of the scaler examination a candidate is informed of their pass / fail status. Where a candidate passes a component of the licensing exam they are required to take an "Oath of Office" in the manner and form prescribed by *regulation*, and file the oath with the secretary of the *Board*.

Upon receipt of the signed "Oath of Office", DNRE issues the candidate a certificate and card, under the signature of the Minister of Natural Resources and Energy, designating their license number.

On their initial license a candidate is issued a four-digit license number. This number will be retained indefinitely. This four-digit number may be suffixed or prefixed by letter code, which denotes the type of license currently issued to the individual. The letter code may be subject to future changes based on a scaler's success on any subsequent examinations written.

A scaler, whose license is designated with a four-digit number only, possesses a full metric license. The four digit number may be suffixed with one or two of the following letters: **P** for pulpwood (stacked measure), **L** for logs, or **T** for treelength, designating a

partial metric license. An **F** preceding the four-digit number designates that the individual is licensed to scale in foot board measure (fbm).

The following examples illustrate codes for various types of licenses:

1492	means the scaler has a full metric license
F1492	means the scaler has a full metric license and a fbm license
1492P	means the scaler has a pulpwood (stacked measure) license only
1492L	means the scaler has a log license only
1492T	means the scaler has a treelength license only
F1492PL	means the scaler has a pulpwood (stacked measure), log and a fbm license
F1492N	means the scaler has an fbm license only. The "N" means the scaler holds no metric license(s).

1.4 Scaler Duties and Responsibilities

The Scalers Act includes in part, the following, relating to Scaler duties and responsibilities:

A scaler shall scale fairly and correctly, to the best of his/her ability and in accordance with the regulations, all primary forest products that the scaler is employed to scale.

Scalers shall submit their books and records of measurement for the inspection of an officer of the *Department* authorized by the *Minister* when called upon to do so, and shall furnish any information and documents that the officer may require.

When required to do so by the Minister, a scaler shall make a sworn return upon forms supplied by the Department, which return shall contain certified copies of the measurements on which the return is based.

If a scaler neglects or refuses to comply with the provisions of the Act or regulations, or is convicted of an offence under the Act, the Minister, upon the advice of the Board, may cancel the Scaler's license.

A scaler who willfully makes false measurements or makes false returns in the discharge of the scalers duties under the Act commits an offence.

A person who hinders, obstructs or interferes with a scaler in the discharge of the scalers duties commits an offence.

Under the "Oath of Office of Scalers" all scalers make oath and say:

1. I will perform the duties of Scaler without fear, favour or affection.

2. I will scale correctly all primary forest products cut upon Crown Lands or marketed through a Producer Association.
3. I will make true scale reports to the Department of Natural Resources and Energy, or its agents, when so required.

1.5 Complaints

A complaint regarding a scale of primary forest products shall be made in writing to the Minister and shall be made before the primary forest products have been moved from the pile in which they were scaled, unless they were scaled in transit.

Where a complaint is made regarding a scale of primary forest products in:

a) Units of m^3(st) or mass, in transit, the *licensee* or *Producer Association* shall cause the primary forest products to be kept on the carrier in their original lengths, or

b) Units of m^3 or fbm, the licensee or purchaser may re-pile the primary forest products in their original lengths separately from other primary forest products in a place and in a manner, which the Minister approves.

Except as permitted in paragraph (b), where the primary forest products are moved before the merits of a complaint are decided upon, the Minister may dismiss the complaint without further action.

Where in the opinion of the Minister a complaint is justified, the Minister shall direct a re-scale be made by a scaler designated by the Minister and such scaling shall be the final determination of the complaint.

1.6 Check Scales

Under DNRE policy, the department has responsibility for evaluating the performance of scalers relative to accuracy and compliance under the Scalers Act and regulation.

Licensed scalers can expect to have a *check scale* performed by a departmental *check scaler* at any time. The results of check scales may be shared with the licensed scaler and their employer. A record of check scale results is maintained by DNRE.

A scaler shall be deemed *consistently not meeting standards* if more than two (2) consecutive check scales per product are beyond the maximum acceptable tolerance (i.e. volume difference, as compared to the DNRE check scaler); or if the scalers performance is beyond the maximum acceptable tolerance on three (3) or more check scales throughout the year, as verified by the DNRE Regional Inspector and/or Chief Scaler. When this happens the scaler is immediately advised of their performance and corrective assistance offered. If a further check scale indicates a satisfactory adjustment has not been made, the scaler will immediately be requested to appear before the Board of Examiners.

The maximum acceptable tolerance of a check scale (on net results) is:

m^3(st) measure	3 % +/-
log m^3 measure	3 % +/-
treelength (swd) m^3 measure	3 % +/-
treelength (hwd) m^3 measure	5 % +/-
fbm measure	3 % +/-
mass / volume sample	2.0 % +/-

Notwithstanding the above maximum acceptable tolerances, scaler measurement and compilation methods are assessed, with respect to the Act and this manual. Variation from the established scaling procedures or extreme variances, on any particular check scale may be deemed *not meeting standard*, at the discretion of the DNRE Regional Inspector and/or Chief Scaler.

2. General Procedures

2.1 The Scalers Act and Regulation

The *Scalers Act Chapter S-4.1* is the legislative authority under which scaling is regulated in the Province of New Brunswick.

The Act itself, covers the general areas of examinations, licensing, duties of scalers and offences.

The General Regulation 83-190 is written under the authority of the *Scalers Act*. This regulation, which deals more specifically with application and administration of the Act is broken down into the following parts:

I. Administration
II. Scaling of primary forest products harvested on *Crown Lands*
III. Scaling of primary forest products marketed through a Producer Association.
IV. Oaths of Office (Scalers, Examiners)

Copies of the Scalers Act and Regulation can be purchased through the Queens Printer Office, Centennial Building, Fredericton NB, or can be viewed at website: www.gnb.ca/0062/acts/index-e.asp.

2.2 Application of Regulation

For the most part, the Regulation is applied consistently, regardless of the origin of primary forest products. There are, however, some notable differences between Part II (Crown Land) and Part III (Producer Association Products). Some of the notable differences include:

a) Scaling in "fbm" is not a recognized form of measurement for primary forest products harvested on Crown lands, however "fbm" scaling (NB Log Scale) is a recognized form of measure for products marketed through a Producer Association.

b) Under Producer Association (*marketing board*) transactions, the principle, founded in common law that two parties may enter into a *contract* with each other is recognized. Throughout Part III of the Act, the term "unless otherwise specified in a contract" commonly appears. This term recognizes that items, which are actually specified in Part II (Crown Land), may actually be negotiated in Part III. For example, red stain is definitely not a defect in scaling primary forest products on Crown Lands and is not a defect for primary forest products marketed through a producer association, unless otherwise specified in contract.

Once items are negotiated and a contract is signed between a producer association and forest industry, the physical scaling is done exactly the same under Part III as is done under Part II.

c) A scaler, operating under Part III, must familiarize himself / herself with the specifications of primary forest products, as defined in the contract respecting the products to be scaled; and they must become familiar with the scaling terms of the contract respecting primary forest products to be scaled and ensure that the products are scaled in accordance with those scaling terms.

2.3 Units of Measure

The cubic metre or mass (tonnes or kgs) may be used as the unit of measure to scale any primary forest product except ship's knees, weir brush, ribbons and top poles (products used in coastal fisheries) which shall be recorded by the piece.

The stacked cubic metre may be used to scale primary forest products cut to uniform lengths of equal to or less than the 2.60 m class, if in piles containing not less than 2.00 m^3(st). In some cases, stacked measure of products greater than 2.60 m in length may be approved, where conversion factors are approved by the Minister. The stacked cubic metre shall not be used as a unit of measure for treelengths, logs, poles, posts, pilings, weir stakes or such other primary forest products, which the Minister may designate.

Board foot measure may also be used to scale logs, which are marketed through a Producer Association.

Where the volume of primary forest products is converted from one unit of measure to another, the conversion factor shall be that conversion factor specified by Appendix A or that conversion factor and method which the Minister may approve.

Throughout this manual the following meanings shall apply:

cm	centimetre
fbm	foot board measure
kg	kilogram
m	metre
mm	millimetre
m^3	cubic metre
$m^3(st)$	stacked cubic metre
$m^3/m^3(st)$	cubic metre per stacked cubic metre
t	tonne (1000 kg)
>	greater than
≤	equal to or less than
=	equals or equal to

Length measurements of m^3(st) products are divided into 0.02 m units with the boundary between units on the odd number as illustrated below:

2.44 m class = > 2.43 - ≤ 2.45
2.46 m class = > 2.45 - ≤ 2.47
2.48 m class = > 2.47 - ≤ 2.49

Length measurements for logs are divided into specified 0.20 m units as per Appendices H and I, and as illustrated below:

2.8 m class = > 2.70 - ≤ 2.90
3.1 m class = > 3.00 - ≤ 3.20
3.4 m class = > 3.30 - ≤ 3.50

Length measurements for poles, posts and pilings are divided into 0.60 m units with the boundary between units on the odd number as illustrated below:

7.0 m class = > 6.70 - ≤ 7.30
7.6 m class = > 7.30 - ≤ 7.90
8.2 m class = > 7.90 - ≤ 8.50

Length estimates for log defects are divided into 0.50 m units with the boundary between units on the odd number as illustrated below:

0.5 m class = > 0.25 - ≤ 0.75
1.0 m class = > 0.75 - ≤ 1.25
1.5 m class = > 1.25 - ≤ 1.75

Diameter measurements are divided into even 2 cm units with the boundary between units on the odd numbers as illustrated below:

10 cm class = > 9 - ≤ 11
12 cm class = > 11 - ≤ 13
14 cm class = > 13 - ≤ 15

2.4 Piling

All piles of primary forest products that are to be scaled shall have a minimum cleared space of one metre on every side.

Primary forest products on which applications are made for special royalty rates shall be piled separately from other primary forest products, unless the scaler has estimated the volume of the primary forest products from a pre-cut inspection.

Primary forest products with different royalty rates shall be piled separately.

Piles of primary forest products that are to be scaled in stacked cubic metres shall contain only *bolts* of the same product length and shall be placed in piles containing not less than 2.00 $m^3(st)$.

All piles of primary forest products that are to be scaled shall be placed on skids. However, if merchantable primary forest products are used for skids or bed logs, a scaler shall include their volume in his scale (if they are part of the load or pile).

Where primary forest products are to be scaled in stacked cubic metres:

a) all hardwood species shall be piled separately from softwood

b) all hardwood species*, except poplar may be piled together

c) all softwood species*, except cedar may be piled together, and

d) poplar and cedar shall be piled separately

* with the same royalty rate

If the species are not piled in accordance with the above conditions, the scaler shall record the whole pile as the species having the greatest royalty value.

A scaler may refuse to scale a pile of primary forest products in stacked cubic metres, if the pile is improperly piled. This means a pile, which has a solid cubic content, less than the m^3 / $m^3(st)$ factor prescribed by Appendix A (ie. excessive air space).

A scaler may refuse to scale any primary forest product which, in the scalers opinion, is not piled in accordance with the regulation or not according to specifications agreed to in contract (for Producer Association products). Refer to Sections 33, 34 of the Regulation for steps to be taken under a refusal to scale.

2.5 Pile Width

Where a pile of primary forest products is scaled in stacked cubic metres, the width of the pile is the average length of the bolts in the pile. A scaler shall determine the average lengths of bolts in a pile by measuring as many bolts as are necessary until satisfied that the average of such measurements is representative of the actual pile width.

2.6 Pile Marking

Scalers shall ensure the following when marking piles or pieces of primary forest products for scaling purposes:

a) except for primary forest products in transit, ensure that all piles are numbered consecutively;

b) ensure that the number marked on the face of each pile is in such a location as to be readily legible from the road or trail being used;

c) mark on the face of each pile in such a location as to be seen and readily legible from the road or trail the date scaled and the scalers initials;

d) in the case of piles of logs, except in transit, have the number of pieces of each species contained in the pile marked on the end of the pile;

e) the length of each log shall be marked on the top end of the log by length class in such a manner as to be readily legible to the scaler. Alternatively, logs of the same length class may be piled together (and grouped separately) with the length class clearly marked on the pile;

f) in the case of treelength, except in transit, have the number of pieces or the number of pieces per class marked on the end of the pile.

2.7 Excessive Defects

Where, in the opinion of the scaler, primary forest products contain such excessive defects that it is impossible to scale and obtain a reasonable measurement, the scaler may recommend to the Minister that the primary forest products be scaled at a *wood processing facility*.

Upon receipt of a recommendation of a scaler, the Minister may order that the primary forest products are to be scaled:

a) on the harvesting block, or

b) at a wood processing facility

2.8 Rounding Rules

The following rules shall apply for rounding numerical data when calculating volumes:

a) when the first digit dropped is less than five, the last digit retained shall not be changed.

Examples: 12.174 m³(st) = 12.17 m³(st)
432.733 m³(st) = 432.73 m³(st)

b) when the first digit dropped is greater than five, or if it is five followed by at least one digit, the last digit retained shall be increased by one.

Examples: 12.157 m³(st) = 12.16 m³(st)
86.76651 m³(st) = 86.77 m³(st)

c) when the first digit dropped is exactly five, followed only by zeros, the last digit retained shall be increased by one if it is odd, but not changed if it is even.

Examples: 12.135 m³(ob) = 12.14 m³(ob)
12.145 m³(ob) = 12.14 m³(ob)

3.9 Scaling Instruments

When scaling primary forest products, a scaler shall not use a scale stick that:

a) deviates from a true measurement more than 1 mm within the boundaries of any 2 cm diameter unit, or

b) deviates from a true measurement more than 2 mm within the boundaries of any 0.20 m length unit.

No scaler shall use a metal or woven tape that exceeds the limits of error shown in Appendix IV.

3. Scaling of Primary Forest Products in Stacked Cubic Metres

3.1 Measurement and Completion

Where primary forest products are to be scaled in stacked cubic metres, a scaler shall measure and record the height, length and width of the pile.

A scaler shall determine the average length and height of a pile by making measurements on both the back and the front of the pile.

A scaler shall measure the height of a pile by placing the hook of the scale stick under the bottom of a bolt in the lowest rank or tier of the pile and reading the perpendicular height to the top of a bolt in the top rank or tier (see Figure 1). Care should be exercised to avoid taking heights on oddly placed bolt ends that would over-represent or under-represent pile height. Height measurements shall be made at equal intervals along the face of the pile. The first measurement shall be made at a point one half the distance of the chosen interval from one end of the pile. The more irregular the height of the pile, the more height measurements shall be made (see Figure 2).

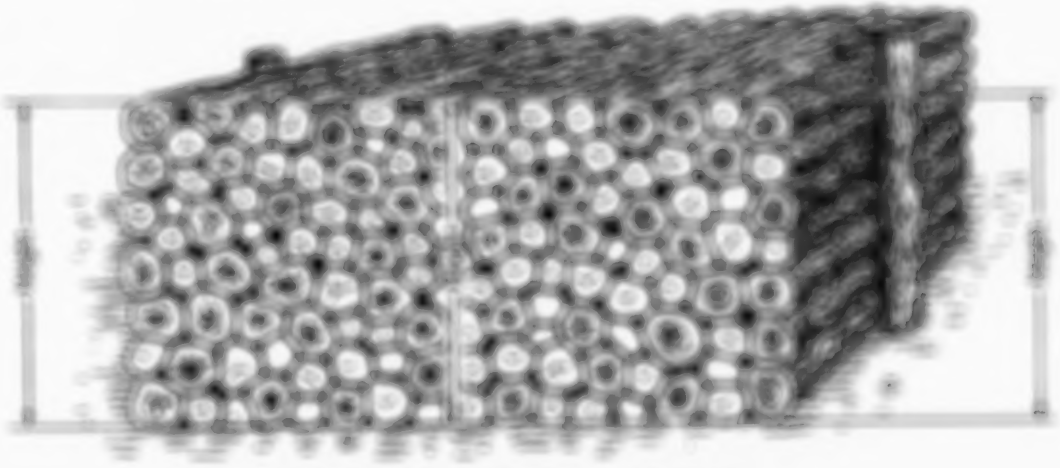


Figure 1. Regular height of stack.

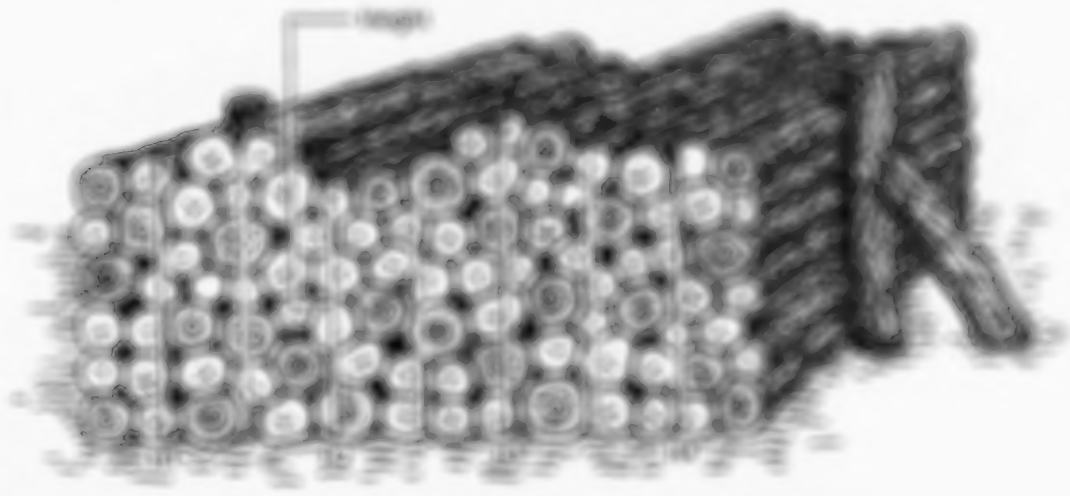


Figure 5. Irregular height of stack

A scaler shall measure and record each height measurement of a pile in 0.05 m units. A scaler shall calculate and record the average height to the nearest 0.05 m unit.

Example: The following height measurements have been taken on a pile of pulpwood:

Side 1	Side 2
1.85	1.85
5.05	5.05
5.05	5.05
5.05	5.10

$$\text{Average height} = \frac{\text{sum of heights}}{\text{number of height measurements}}$$

$$= \frac{32.00}{6}$$

$$= 5.150$$

$$= 5.15 \text{ m}$$

Note: The boundary between 0.05 m size classes is on the odd number in the preceding example the 5.15 class boundaries are < 5.10 m ≤ 5.20 m. Therefore the recorded average height is 5.15 m.

Averages of measurements are always stated in even 0.05 m classes to be recorded to the nearest 0.05 m unit. Length, height and width measurements, other individual measurements or averages, must end in an odd number.

The length of a pile is the distance between the exterior edges of the bolts on each end of the pile. When a pile of primary forest products drops off in height at one or both ends to form a slope, the length measurement shall be taken:

a) to a point where half the height of the pile intercepts the line of the slope (Figures 3 and 4); or

b) at the points that describe the maximum length of the pile (Figure 5).

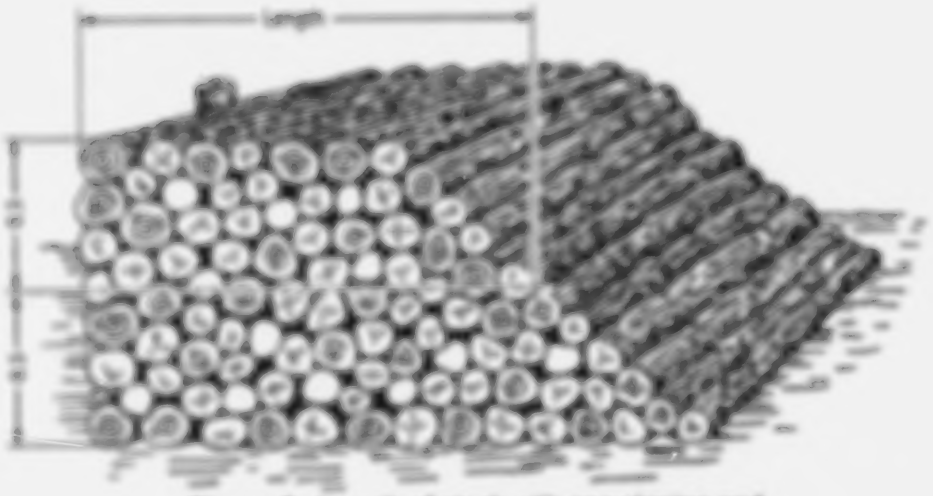


Figure 3. Length of stack with one sloping end.

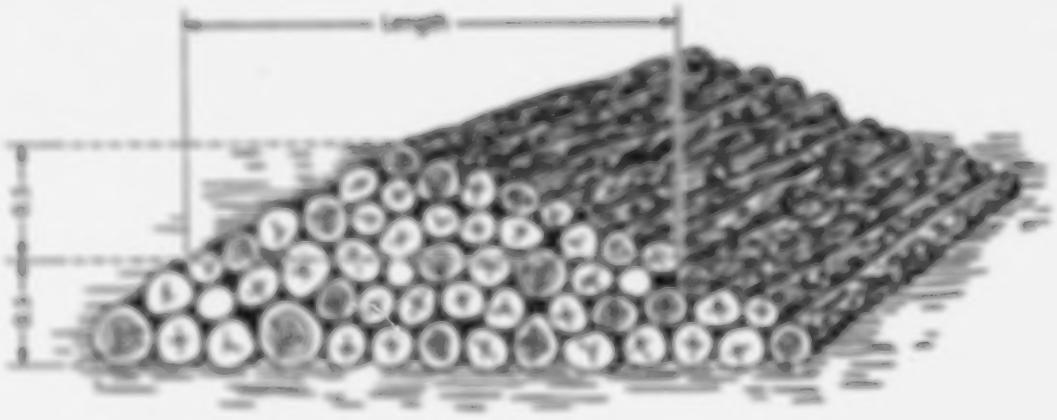


Figure 4. Length of stack with both ends sloping.

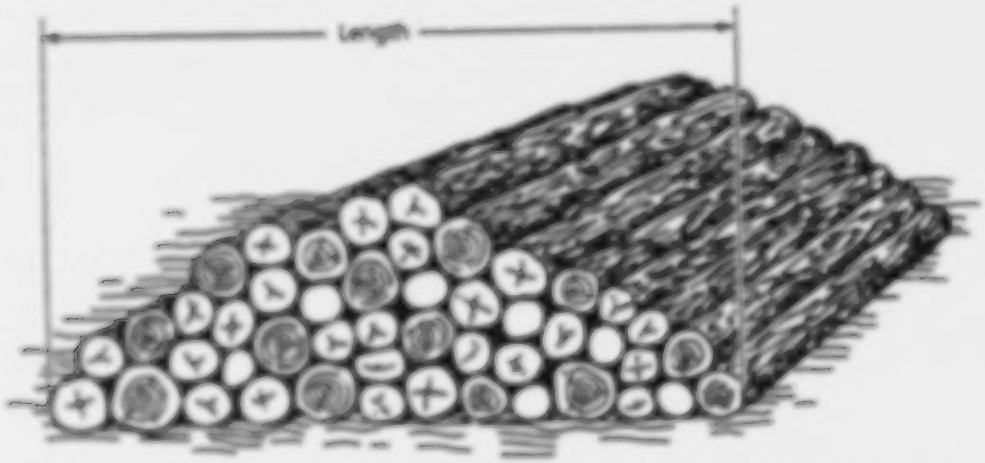


Figure 5. Length of stack measured at points that define the maximum length.

Where a pile is on a slope, a scaler shall measure lengths parallel to the bottom of the pile (or the slope of the ground) and heights perpendicular to the bottom of the pile (Figures 6 and 7).

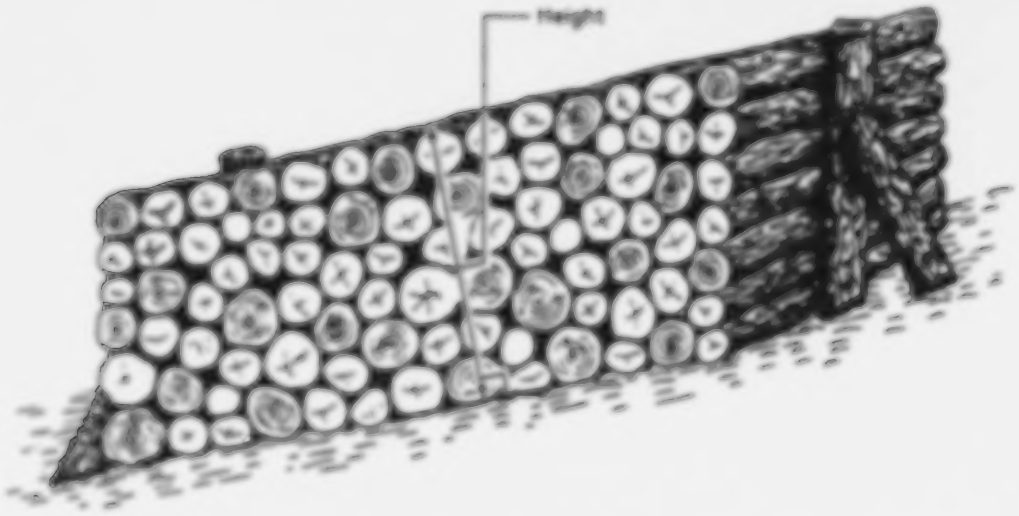


Figure 6. Height of stack parallel to slope of ground.

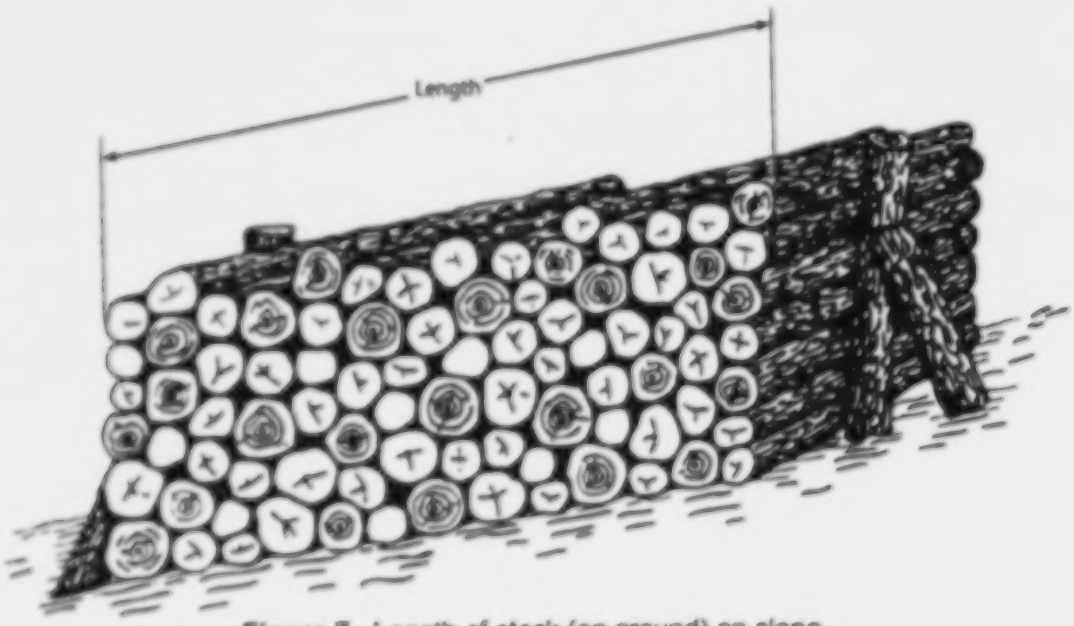


Figure 7. Length of stack (on ground) on slope.

A scaler shall measure and record each length measurement of a pile in 0.02 m units. A scaler shall calculate and record the average length to the nearest 0.02 m unit.

Height measurements must be related to the type of length measurements employed (or vice versa). If the total length of the pile is measured, heights must be taken throughout the full length of the pile (see Figure 8). When the length of the pile has been estimated at less than the full length, height measurements must be taken, within the range of the estimated length, at points that reflect the height of the squared pile. This practice is normally referred to as "squaring up the pile" (see Figure 9).

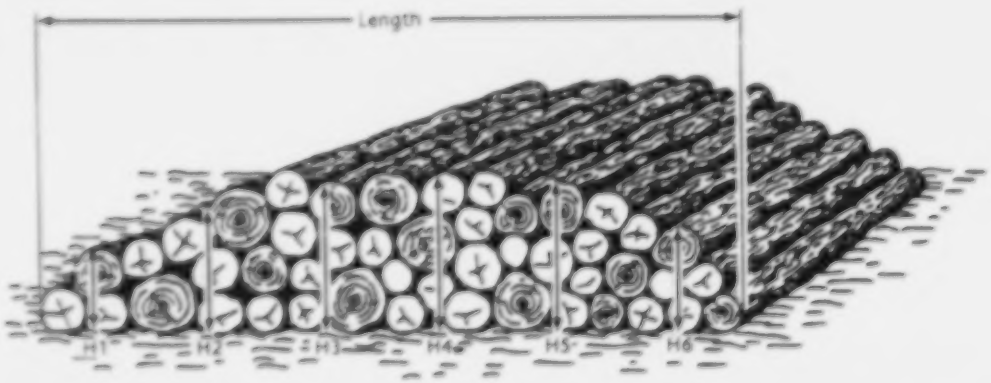


Figure 8. Height of stack with total length.

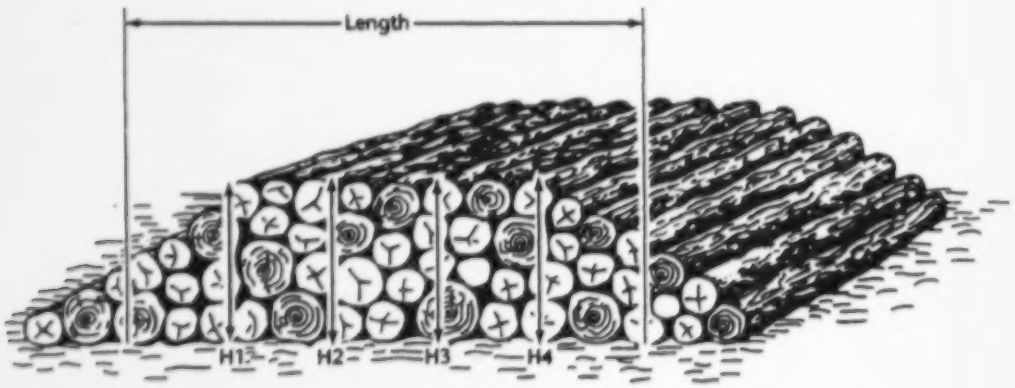


Figure 9. Height of stack with length estimated at less than total.

A scaler shall measure and record each width of the pile (length of bolt) measurement in 0.02 m units. A scaler shall calculate and record the average width to the nearest 0.02 m unit.

If a pile does not contain bolts of approximately the same length then a scaler may refuse to scale the pile.

When a scaler has determined the average length, height and width of a pile of primary forest products, the gross pile volume is then calculated in stacked cubic metres by using the following formula:

$$GPV = (L)(H)(W)$$

Where GPV = gross pile volume expressed to 0.01 m^3(st)

L = average length of pile, m

H = average height of pile, m

W = average width of pile, m

Example: L = 12.76 m
H = 2.14 m
W = 2.44 m

$$GPV = (L)(H)(W)$$
$$= (12.76\ m)(2.14\ m)(2.44\ m)$$
$$= 66.628$$
$$= 66.63\ m^3(st)$$ (This may be an odd number)

3.2 Deductions m³ (st)

When making deductions for defects in primary forest products, scaled in stacked cubic metres, the scaler shall:

1. On piles that are less than 2.44 m in width:

    a) Alternate the side of the piles on which defect measurements are made.

    b) On uneven numbered piles, measure defects on the side away from the road or trail, and on even numbered piles, measure defects on the side facing the road or trail.

    c) Make deductions for a visible defect as if it extended through the length of the bolt.

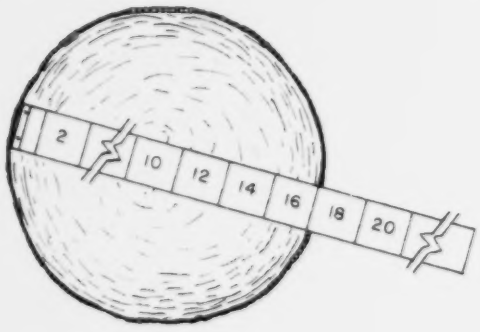
2. On piles that are 2.44 m or greater in width:

    a) Measure defects on both sides of the pile.

    b) Make deductions for visible defect as if it extended for half the bolt length.

When determining cull deductions, a scaler shall measure bolt or half bolt diameters inside the bark along a plane perpendicular to the longitudinal axis of the bolt. A scaler shall record and calculate the average bolt or half bolt diameter to the nearest 2 cm unit. Where the diameter of a scaled piece coincides with the boundary between classes, that piece shall be measured and recorded to the lower class.

Example:

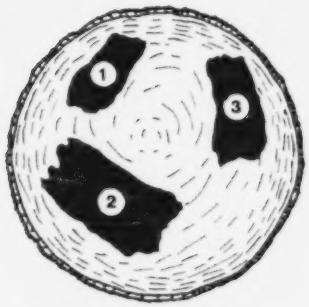


In this example, the inside bark diameter of this bolt falls exactly on the boundary between the 16 and 18 cm size class. The diameter of this bolt is 16 cm class.

Where several defects are scattered over the surface of a bolt, a scaler may:

a) make a deduction for one defect having a diameter equal to the square root of the sum of the products of the diameters of each defect, expressed to the nearest 2 cm unit.

Example:



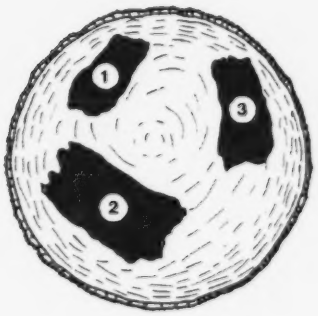
Defect 1 = 2 cm by 6 cm
2 = 4 cm by 10 cm
3 = 2 cm by 8 cm

Deduction = square root {(2x6)+(4x10)+(2x8)}
= square root { 12 + 40 + 16 }
= square root { 68 }
= 8.2 = 8 cm class

Assuming this is a 2.50 m bolt of rough softwood pulpwood the volume deduction would be 0.011 m^3(st) (see Appendix B)

b) make a deduction for each defect separately by its average diameter, expressed to the nearest 2 cm unit.

Example:



Defect 1 = 2 cm by 6 cm
2 = 4 cm by 10 cm
3 = 2 cm by 8 cm

Deductions $1 = \frac{2+6}{2} = \frac{8}{2} = 4$ cm

$2 = \frac{4+10}{2} = \frac{14}{2} = 7 = 6$ cm

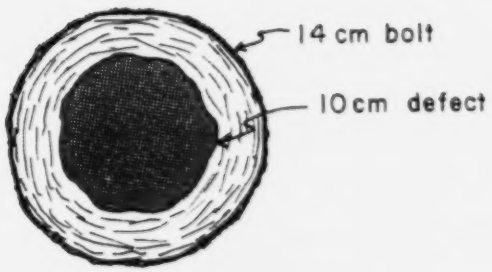
$3 = \frac{2+8}{2} = \frac{10}{2} = 5 = 4$ cm

Assuming this is a 2.50 m bolt of rough softwood pulpwood, the volume deduction would be 0.003 + 0.006 + 0.003 = 0.012 m^3(st) (see Appendix B).

Where the diameter squared of a defect is greater than half the diameter squared of the end being measured, the bolt or half bolt is a cull and a scaler shall make a deduction equal to the total diameter of the bolt or half bolt.

Example:

1. Is this bolt a cull?

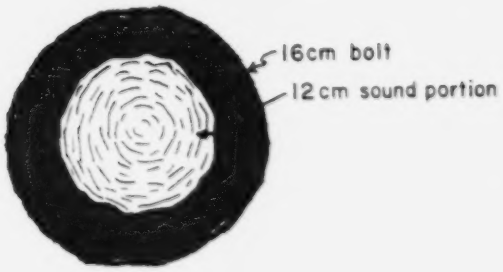


Bolt diameter² = 14 x 14
= 196 cm²

Defect diameter² = 10 x 10
= 100 cm²

Since 100 is greater than half of 196, the bolt is a cull and a deduction equal to a 14 cm bolt is made.

2. Is this bolt a cull?



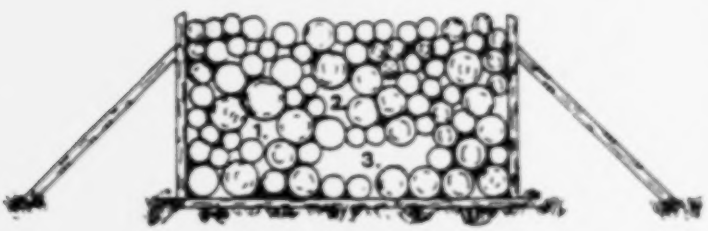
A 16 cm bolt has a sap rot leaving a sound portion of 12 cm.

Bolt diameter² 16 x 16 = 256
Sound portion² 12 x 12 = 144
Defective portion = 112 cm²

Since 112 cm² is less than half of 256 cm² the bolt is not a cull. However, a deduction equal to the square root of 112 = 10.58 = 10 cm must be made for the sap rot.

A void is an unnecessary space in a pile of stacked primary forest products, large enough to accommodate at least the equivalent volume of the average bolt in the pile. If the space is large enough to accommodate at least the equivalent volume of the average bolt in the pile, then the space is a void and a deduction shall be made. If it is not large enough, then the space is considered normal airspace and no deduction shall be made. A void may be more or less circular in shape, rectangular, square or any shape large enough to accommodate at least the equivalent volume of the average size bolt in the pile. A scaler must take special care to determine the full depth of the air space when considering the average dimension of the potential void.

Example:



Average size bolt in the pile = 14 cm.

This is determined or estimated by the scaler.

Pile width is 2.50 m.

Hole 1: Dimensions measured 14 cm x 16 cm x 1.25 m (½ pile width)

Average diameter = $\frac{14 + 16}{2}$ = 15 = 14 cm class

A deduction of 14 cm is made.

Hole 2: Dimensions measured 10 cm x 14 cm x 1.25 m (½ pile width)

Average diameter = $\frac{10 + 14}{2}$ = 12 = 12 cm class

Since the average size bolt is 14 cm the hole is <u>not</u> a void and no deduction is made.

Hole 3: Note: this type of hole may be created by a band of snow or ice in winter or if a bolt is cross-wise in the pile or load.

Dimensions measured 20 cm x 40 cm x 1.25 m (½ pile width)

Average diameter = $\frac{20 + 40}{2}$ = 30 = 30 cm class

In the case of Hole 3, if the hole had been 20 cm x 60 cm, the scaler would then divide the length of the hole by the height of the hole and take that many deductions, in height sized bolts (H).

Example: $\frac{\text{Length}}{\text{Height}} \quad \frac{60 \text{ cm}}{20 \text{ cm}} = 3$

Make (3) 20 cm deductions rather than (1) 40 cm deduction, which would grossly overestimate the amount of the deduction.

<u>Rule of Thumb</u>: When a void is long and narrow (length is greater than twice the height) make a deduction by dividing the length by the height and make that many deductions in height-sized bolts (H).

$\frac{L}{H}$ = number of "H" sized bolts to deduct

Where a void exists in a pile of primary forest products, a scaler shall make a deduction equal to the volume of the largest bolt that could reasonably be accommodated in the void.

A scaler may calculate the deduction for a defect or void:

a) by measuring the diameter and then determining the volume of the deduction from the tables contained in Appendix B, C, D, E, F, G, O, P, Q or R

b) by applying a percent reduction of the gross volume, or

c) by any other means which the Minister may approve.

If the diameter of a defect or void is not contained in Appendix B, C, D, E, F, G, O, P, Q or R, a scaler shall calculate the volume of the defect or void, in accordance with the formula prescribed by Appendix B, C, D, E, F, G, O, P, Q or R.

Where the length of bolts or half-bolts is greater than or less than the Appendices formula length (L), the values in the tables of Appendices B, C, D, E, F, G, O, P, Q and R shall be increased or decreased by the percentage that the length of the bolts or half-bolts exceeds or is less than the Appendices formula length (L).

For all primary forest products, rot is a defect but red stain is not a defect.

At the top of Appendices B, C, D, E, F, G, O, P, Q and R there is a formula for calculating the deduction in stacked cubic metres to be made when the diameter of the defect or a cull bolt has been measured. For the purposes of illustration, the derivation of the formula in Appendix B will be explained. The other Appendix formulas are derived in a similar manner.

Appendix B shows the deduction values of defects or voids, by diameter, in stacked cubic metres for 2.50 m Rough Softwood Pulpwood. The formula reads:

$m^3(st) = A \times L \times$ Rough Wood Factor

$A = (0.00007854)(\text{diameter of defect cm})^2$

[1] L = 1.25 m (this is ½ bolt length for 2.50 m pulp)

[2] Rough Wood Factor = 1.7135

[1] half bolt length for all products 2.44 m or greater in length.

[2] 1 ÷ 0.5836 (Conversion Factor from Appendix A). Essentially, the conversion factor, or $m^3/m^3(st)$, is converted to a Rough Wood Factor, or $m^3(st)/m^3$.

Example: 10 cm defect in 2.50 m Rough Softwood Pulpwood

$m^3(st)$ = A x L x Rough Wood Factor

= (0.000078654) $(10cm)^2$ x 1.25 m x 1.7135 $m^3(st)/ m^3$

= 0.0098175 m^3 x 1.7135 $m^3(st)/ m^3$

= 0.0168 $m^3(st)$

= 0.017 $m^3(st)$

4. Scaling of Primary Forest Products in Cubic Metres

4.1 Measurement and Compilation

In this section the following terms apply:

piece: includes logs, poles, tree lengths, posts and piling.

smallest top diameter: means the smallest diameter inside bark which can be measured through the geometric center at the top end of a log, pole, post or piling.

smallest butt diameter: means the smallest diameter inside bark, which can be measured through the geometric center at the butt end of a tree length.

The scale of any primary forest product in cubic metres may be either complete or partial. In the case of a partial scale, the scaler shall measure the diameter and length of a sufficient number of pieces until satisfied that the measures are representative of all the lengths and diameters in the pile. The greater the range in dimensions, the higher the percent of partial scale (ie. the greater the number of pieces required to be scaled). When doing a partial scale, the scaler shall include cull pieces (ie. no merchantable volume) in the calculation of the average net volume per piece.

Example: On an operation, 320 spruce logs were scaled with a net volume of 100.480 m^3. This included 7 culls. The total number of spruce logs on the operation was 750. What is the average net volume per piece and the total net volume of all pieces on the operation?

Average net volume per piece = 100.480 ÷ 320 = 0.314 m^3

Total net volume = 0.314 x 750 = 235.500 m^3

The *smallest top diameter* and the *smallest butt diameter* must be measured through the geometric center. The geometric center of a piece is that point on the end cut surface of the piece through which the scale stick is hinged so that there is as much wood fibre on one side of the stick as there is on the other (see Figure 10). It is not necessarily the same point as the pith, the biological centre of the piece.

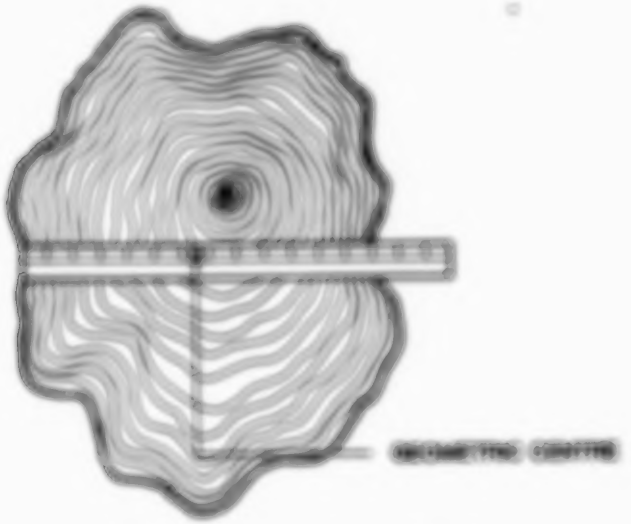


Figure 10. Geometric centre.

4.2 Logs

Logs are scaled by measuring the smallest top diameter in 2 cm units and the length in specified 0.20 m length classes. The volumes, in m^3 to three places of decimal, is determined from the table contained in Appendix III for softwood logs and Appendix II for hardwood logs.

Logs that are longer than a specified length class shall be scaled as belonging to the next larger length class.

4.3 Poles, Posts, Pilings and Wetrelatives

Poles, posts, pilings and wetrelatives are scaled by measuring the smallest top diameter in 2 cm units and the length in 1.0 m units. Using these measurements, a scaler shall determine the volume of spruce, tamarack, jack pine and red pine poles, posts, pilings and wetrelatives from the table contained in Appendix J and the volume of cedar poles and posts from the table contained in Appendix K.

4.4 Tree length

Tree lengths, softwood or hardwood, may be scaled by the smallest butt diameter method. When using this method to scale tree lengths a scaler shall:

a) measure and record the smallest butt diameter; and

b) determine the volume from the appropriate tree length cubic metre volume table, which the Minister has approved.

A scaler must ensure that the small butt measurement incorporates normal contours and depressions, along the facing edge, when determining the placement of the scale stick across the geometric centre. Abnormally deep cracks, crevices or indentations affecting the butt surface area may be disregarded, if the point of measurement would grossly misrepresent actual stem volume. Cracks, crevices and indentations may be the result of natural or mechanical damage and may be fresh or healed wounds (ex. lightning scars, spike, harvesting damage).

A scaler must know how a tree length volume table is constructed, in order to properly use a table. These tables are constructed based on measurements of tree length samples from a designated area. The felled tree length samples are individually measured using the stem analysis method (see Stem Analysis section 7.3). The trees are then sorted by smallest butt diameter. The average volume of all trees in each diameter class is then determined as well as the frequency (number of trees) in each diameter class. These values are then fitted to a curve resulting in the construction of a local volume table, applicable to the area from which the data was collected.

6.6 Deductions – Logs [1]

When scaling logs in cubic metres, a scaler shall make deductions for those defects, which show on either or both ends of the piece. The diameter of a defect, or the average of two diameter measurements where the defect is irregular, shall be measured and recorded in 2 cm units.

A scaler may calculate the deduction for a defect

a) by measuring the diameter of the defect and estimating the length of the defect in 0.3 m units, then determining the deduction from the table contained in Appendix I. (Note: the estimate of the length of the rot is based on the scalers experience for the species involved, as well as the surface area and degree of rot); or
b) by applying a percent reduction; or
c) by such other method which the Minister may approve.

Where the diameter of the defect is not contained in Appendix I, a scaler shall calculate the volume of the defect in accordance with the formula and method prescribed by Appendix I.

A scaler shall not make any deduction for:

a) checks or splits, scars, crook, sweep or other irregularities in form;
b) worm holes;
c) abnormal discoloration that is not due to rot (such as a mineral stain in birch or most hardwoods);
d) red stain.

Red is a defect.

Any log with more than one-third but less than one-half of its gross volume defective by rot, crook, sweep and/or seam shall be classified as a pulpwood log.

Where more than one-half of the gross volume of a log is defective by rot, a deduction equal to the total gross volume of the log shall be made.

Example 1:

Rot extends only a portion of the length of a spruce log (see Figure 11).

Figure 11: Rot showing on one end of log

Gross Log Volume = (Mid-log, 0.3 m length (10.12 cm))
= reference figure(s) 1 = 0.068 m³

Volume of rot = (10 cm (butt rot) + 0.3 m (estimated length))
= reference figure(s) = 0.020 m³

Net Log Volume = Gross Volume – Rot Volume
= 0.068 – 0.020
= 0.051 m³

Example 2:

Rot extends the full length of a spruce log (see Figure 12).

Figure 12: Rot showing at both ends of log

Gross Log Volume (32 cm top, 5.0 m length (16 Class)

Reference: Appendix H = 0.529 m³

Volume of Rot (from Appendix L)

Butt Rot:	28 cm x 5.0 m	= 0.154 m³
Top Rot	24 cm x 5.0 m	= 0.113 m³
Total Rot Volume		= 0.267 m³

Net Log Volume = Gross Volume – Rot Volume
= 0.529 – 0.267
= 0.262 m³

This log is a cull since 0.262 m³ represents only 49.5 % of the gross log volume of 0.529 m³ (ie. greater than 50 % defective due to rot). In this case a deduction equal to the gross volume of the log shall be made.

Note: When log length does not correspond exactly with the length of rot given in Appendix L, use the length of rot shown in the Appendix which is closest to the log length (see notes on Appendix L).

4.8 Deductions – Tree length m³

Tree length volume tables, constructed by the Stem Analysis Method (see section 7.3) may be either gross or net. In most cases, tree length tables are net tables. These net tables have a cull factor (or rot factor) built into them to account for rot (see Developing Cull Factors, section 7.5). Cedar, and other species, may have either gross or net tables developed for a specific area. The scaler must be aware of which type of table (gross or net) is being used, as royalty is based on net volume. If a gross table is being used, a percentage reduction approved by the Minister shall be applied to the gross scale of all tree lengths to arrive at a net volume.

5. Scaling of Primary Forest Products in Mass

5.1 Measurement and Compilation

In this section the following terms apply:

ovendry means a condition in which the wood has ceased to lose moisture after being subjected to a temperature of 103 ± 2° C in a ventilated oven, for the purposes of determining moisture content;

moisture content means the mass of water in wood expressed as a percentage of its total mass

When scaling primary forest products by mass, a scaler shall determine the mass by the use of motor vehicle scales or such other appropriate weighing machines that conform to the *Weights and Measures Act (Canada)* and any regulations thereunder.

The weigh scales must be of sufficient capacity to determine the mass of the loaded vehicle in one operation.

A scaler shall:

1. weigh the primary forest products together with the vehicle on which the products are being transported and determine their mass, and,

2. after unloading the products, weigh the empty vehicle and determine its mass, and,

3. determine the mass of a load of primary forest products by subtracting the mass of the empty vehicle from the mass of the loaded vehicle.

The mass of a load of primary forest products shall be determined and expressed to the nearest 10 kg or 0.01 t and shall include, if present, bark, moisture, rot and foreign material.

Where mass is converted to cubic metres, a mass to volume conversion factor shall be applied, as approved by the Minister. Mass to volume conversion factors will account for deductions of bark, moisture, rot and foreign material through sampling procedures approved by the Minister, and no further deductions shall be made (see Developing Mass / Volume Relationships, section 7.7).

An alternative deduction method allows a scaler to make deductions for the mass of defects or foreign material by a percentage reduction of the gross mass, if the Minister approves these deductions or if deduction methodology is specified in a contract.

The mass of wood, as chips, may be reduced to the ovendry mass of bark-free wood after being sampled for bark and moisture content. If mass is to be reduced to an ovendry basis, then a sufficient number of samples of moisture content and bark content determinations must be made to satisfy the Minister that the average values so determined are representative of the population they purport to represent.

5.2 Measurement Canada

Measurement Canada enforces the *Weights and Measures Act and Regulations*, which applies to weigh scales used to measure primary forest products. The Department of Natural Resources and Energy cooperates with Measurement Canada through a working relationship to aid both agencies in an effort to ensure compliance with the legal requirements of both federal and provincial legislation.

5.3 Weigh Scale Maintenance and Testing

Weigh scale maintenance and testing is critical to ensuring consistent and accurate measurement of primary forest products. The following visual inspections, usage tests and weight indicator tests are minimum recommended practices that should be included in all scale operators routine scale maintenance programs.

If problems are detected, beyond acceptable tolerances, immediate attention is required to remedy the problem. Scale owners and operators are legally responsible to ensure corrective action is taken. If this is not possible, other means of measurement are to be used.

Special attention should be given to seasonal conditions that create problems with debris buildup, such as mud and ice around the platform and load cells.

5.3.1 Visual Inspection

- Approach and ramps to be level and plane with the weigh scales for a distance of at least 3 metres on each end.
- Scale approach, platform and surrounding area free of foreign material
- Scale load cell unit free and clear of debris (ice, snow, water, mud or dirt)
- Under the scale and ends also free and clear
- Note the function of the weight displays. Compare indicator, scoreboard and printer to ensure consistency.

5.3.2 Usage Tests

- For attended scales, verify that the operator is zeroing the scale before a load is supported on the truck scale. The operator must have visual confirmation that the load being weighed is fully supported on the scale and only then prints the weight.
- For fully unattended scales, an automatic means must be indicated to the driver that the indicating element of the scale has returned to zero and the operator may drive onto the weigh scales. A printed ticket should not be given unless there is an automatic means to ensure that the load is fully supported on the weighing device.
- When loads are removed from scales, also observe the time required for the display to return to zero. The scale must return to zero within 30 seconds (unless affected by extreme wind or weather conditions).
- Stored tare weights are not to be used.

5.3.3. Section Test

- This test will indicate whether the device is weighing with precision at all points on the platform and will provide indication of a malfunctioning load bearing point (load cell, lever).
- The test is carried out by using a test vehicle (truck or loader) with a recommended minimum weight of 20000 kg.
- To test the sections, first zero the scale and then move the test vehicle onto the scale as close to the inbound end as possible and record the weight. Ensure that the load being weighed is fully supported on the scale. Move the test vehicle three to five positions on the scale (full coverage from end to end) and record the weight each time. The same procedure is then repeated by turning the vehicle around and moving it across the scales in the opposite direction.
- The difference between the highest and lowest reading gives the error found on the scale. The scale is not within tolerance if the error is greater than the limits, as defined under Weights and Measures Regs.
- A tolerance guideline, for Motor Vehicle scales weighing in 10 kg increments, is as follows:

Test Vehicle Weight	Tolerance
20000 kg	30 kg
40000 kg	60 kg
60000 kg	80 kg

Example: Weights direction 1: 25400 25420 25480 25410
Weights direction 2: 25390 25410 25470 25400

Greatest difference is 25480 – 25390 = **90** kg
Error exceeds tolerance therefore maintenance is required.

6. Scaling of Primary Forest Products in FBM

6.1 Measurement and Compilation

The New Brunswick Log Scale[1] (Appendix M) is essentially a diagram rule, as opposed to a mathematical or formula rule, and was devised more than a century ago.

The NB Log Scale shows the amount of lumber, which may be sawn from logs of different sizes under certain assumed conditions, and only approximates the manufactured volume. Some influences that may affect actual volume sawn include changes in market requirements, machinery, sawing practices and the skill of the sawyer and / or edgerman.

Factors which could increase the volume sawn from a given log over the scaled volume (ie. over-run) are:

Strong top diameters
Fast Taper
Sawing 2", or 3" or thicker stock
Defects not as serious as estimated
Narrow saw kerf
Sawing scant

Conversely, factors which could adversely affect the volume sawn from a given log (ie. under-run) are:

Hidden defects
Inaccuracy of mill machinery
Sawing special sizes

The scaling of primary forest products, in board feet, requires the measuring and recording of the length of the log in feet, and the diameter, inside bark, of the small end in inches. The length shall be measured from the point of any scarf and recorded to the nearest foot, and the diameter, inside bark, shall be recorded to the last full inch after dropping all fractions.

In the example (see Figure 13), the diameter would be recorded as 7". The over-run on the diameter should be taken into account when allowing for minor defects. The length would be recorded as 16'.

[1] The New Brunswick Log Scale does not conform to CSA Standard 0302.1-00.

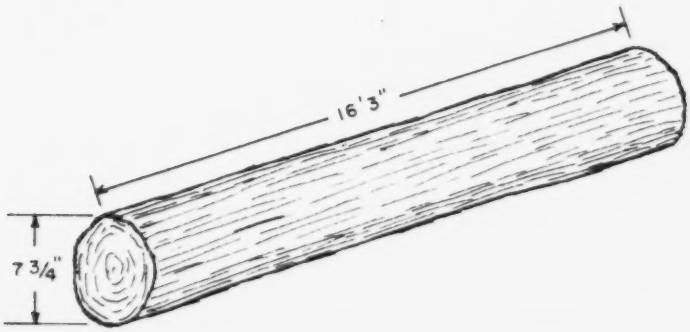


Figure 13. Determining log dimensions – fbm.

The scaler, when working through a brow of logs shall make diameter measurements wherever possible in a consistent manner, with the scaling stick held either horizontally, vertically or diagonally, without attempting to determine the smallest diameter (see Figure 14). However, if the sawn surface to be measured is abnormally shaped with a difference of two or more inches between two inside bark diameters taken at right angles to one another, the scaler shall record the mean diameter to the last full inch (see Figure 15).

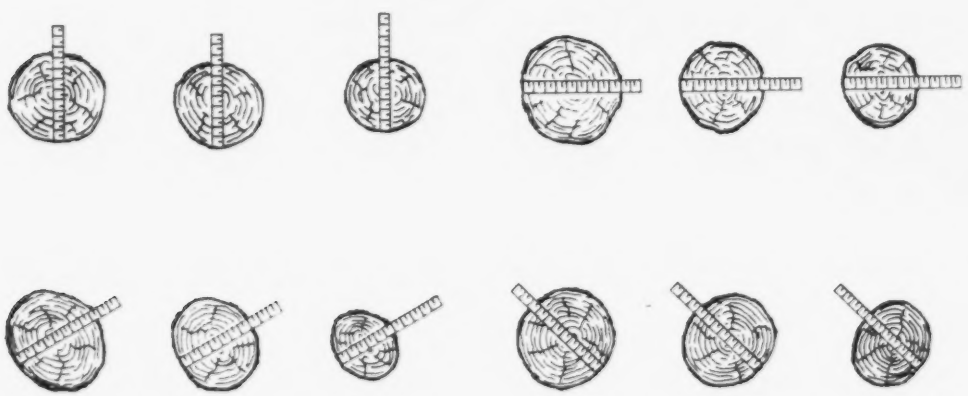
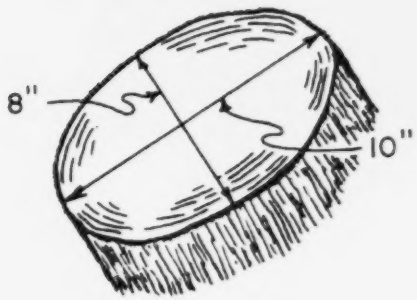


Figure 14. Consistent scale stick measurements.



Record as a 9" diameter

Figure 15. Mean diameter.

To convert the measurements of length and diameter of logs into board-foot volume, the scaler shall use the New Brunswick Log Scale, Appendix M.

All logs shall be counted and so marked as to be readily identifiable. Logs shall be separated by species and the number of logs of each species shall be recorded on each brow.

A scale of primary forest products in board feet may be either complete or partial.

Where a scaler undertakes a partial scale, the scaler shall measure the diameter and length of a sufficient number of pieces until satisfied that the measures are representative of all the diameters and lengths in the pile.

Where a scaler undertakes a partial scale, cull pieces shall be included in the calculation of the average net volume per piece.

Example: In a partial scale of 320 logs, 128 were actually scaled and these included 4 culls. The net volume of the 124 merchantable logs was determined as 3968 board feet; the average net volume per log would be 31 board feet (3968 ÷ 128). The total net scale would be 31 x 320 which is 9920 board feet.

6.2 Deductions FBM

Log measurement or scaling would be a simple matter if all logs were straight and sound. However, many logs contain certain defects that reduce the volume of merchantable lumber that may be sawn from them, consequently the scaler must allow for these defects in the scale.

The scaler must take into account only those defects that are visible. When making deductions for defects, especially minor ones, the scaler shall take into account any over-run in top diameter.

Example: A 16' log with a top diameter (i.b.) of 12¾" would be scaled as a 12" diameter for a volume of 96 bd. ft. Since the diameter is 12¾" it would have an approximate volume of 108 bd. ft. or an over-run of some 12 bd. ft. Therefore, in this case, a minor defect of 6 bd. ft. for butt rot could be ignored.

Also, no deductions shall be made for any defects lying outside the cylinder projected from the top end of the log as there is no allowance made for taper in the New Brunswick Log Scale (see Figure 16).

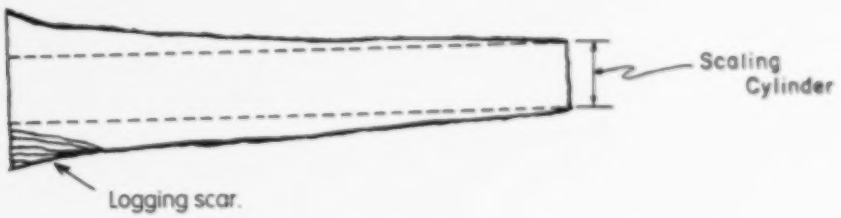


Figure 16. Logging scar lying outside the scaling cylinder.

Unless otherwise specified in a contract, rot is a defect but red stain is not. No deductions shall be made for sound green knots unless occurring in abnormal quantities.

Deductions for defects may be made either by a reduction of length and / or by a reduction of the diameter, or by a percent reduction of the gross volume, or by such other methods as approved by the Minister.

If there are several defects showing on the end surface of a log, so grouped as to prohibit the sawing of a one-inch board between them, they shall be considered as one defect.

The diameter of a defect or the average of two diameters if it is irregular, shall be recorded to the nearest inch.

The scaler, after determining the board-foot volume of any defect, may reduce the gross volume of the log by the calculated volume of the defect, and from the New Brunswick Log Scale locate the volume figure closest to the calculated net figure, then tally the corresponding length and diameter.

Example: A 12' log with a top diameter of 10" has a gross volume of 48 bd. ft. It has been determined that the volume of heart rot in this log is 13 bd. ft., therefore the net volume is 35 bd. ft.

From the New Brunswick Log Scale this log could be tallied either as a 12' log with a top diameter of 9" (36 bd. ft.) or a 9' log with a 10" top diameter (36 bd.ft.).

As an alternative, the scaler may tally the log by its measured length and diameter. Then, in the New Brunswick Log Scale under the log length measured, locate the volume figure closest to the calculated volume of the defect, and read the corresponding diameter; then tally, as a deduction, a log with the length as measured and diameter as determined.

Example: A 16' log with a top diameter of 11" has a gross volume of 80 bd. ft. A third of the log is considered as defective i.e. approximately 27 bd. ft. Therefore a 14' log with a 7" top diameter (27 bd. ft.) could be tallied as the deduction.

Defects in logs are often grouped into three categories, namely interior, exterior and form. It is possible that any one log may be affected by more than one type of defect. For example, butt rot (interior) and sweep (form) may be associated in the same log.

To aid the scaler in making deductions for defects, the following examples in this section are shown. It should be borne in mind that strong diameters can offset minor defects since the New Brunswick Log Scale requires that the scaler measure the top diameter (i.b.) to the last full inch.

Interior Defects occur on the inside of the log and commonly consist of:

a) butt rot
b) top rot
c) heart or center rot
d) shake
e) heart or star check
f) patchy rot

The diagram or blocking out method may be employed in allowing for interior defects.

Example: An area of butt rot measures 6" by 5" and the scaler estimates its length as 4'. The volume to be deducted is:

$$\frac{6" \times 5" \times 4'}{15} = 8 \text{ f.b.m.}$$

Note: 15 is used instead of 12 for a divisor. This is to account for the ¼" saw kerf, which causes 20 % of the log to be lost in sawing. This allowance for saw kerf has already been accounted for in construction of the N.B. Log Scale Table.

Butt or top rot

When estimating the length of butt or top rot defects (see Figure 17), the scaler should consider the degree of rot, the species and the surface area of the rot.

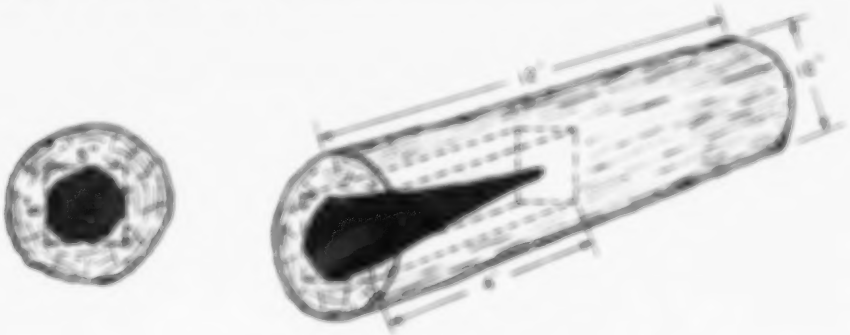


Figure 17. Blocking out butt or top rot.

Volume of rot = $\frac{5" \times 5" \times 4'(\text{est. length})}{15}$
= 7 f.b.m.
Gross scale of log = 72 f.b.m.
Net scale of log = 72 – 7 = 65 f.b.m.

The log would be recorded as 13' log and 11" diameter (65 bd. ft.)

Heart or center rot

A reduction in length or diameter may be made to allow for a defect; however major defects such as heart or center rot (see Figure 18) usually require a reduction in diameter.

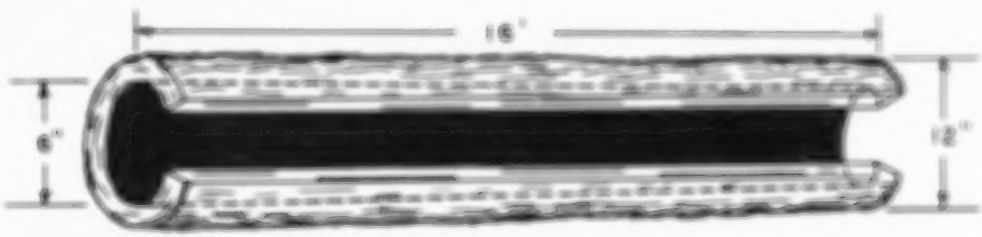


Figure 18. Heart or center rot extending full length of log.

Volume of defect = $\frac{6" \times 6" \times 16'}{15}$
= 38 f.b.m.
Gross scale of log = 96 f.b.m.
Net scale of log = 96 – 38 = 58 f.b.m.

This log could be recorded as 14' long and 10" diameter (56 bd.ft.), or a 10' long and 12" diameter (60 bd.ft)

Note: Logs with more than one-half of its gross volume defective shall be considered as a cull and a deduction equal to the total gross volume of the log shall be made.

Shake

Shake is the separation of the wood along the annual rings in a log. It is very common in hemlock, but it may occur in any species. If detected on both ends of a log it may be assumed that this defect extends through its entire length. If observed on one end, usually the larger, it probably extends half the length of the log. Deductions are usually made by the diagram method (see Figure 19). This defect is common in hemlock, which is usually squared, rather than sawn into one-inch boards.

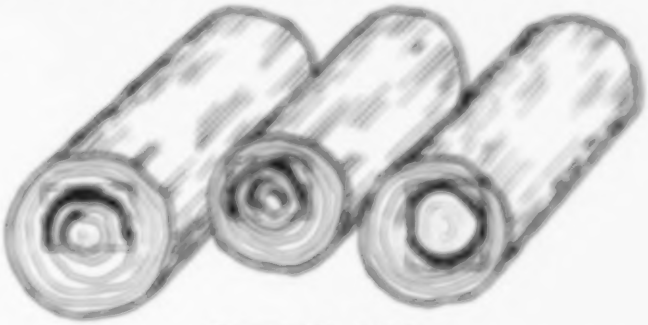


Figure 19. Shake.

Example: Shake measures 6" x 7" and extends the length of the log, which is 14'.

$$\text{Volume of deduction} = \frac{6" \times 7" \times 14'}{13}$$

$$= 39 \text{ bd ft.}$$

Heart or Star Check

Caution should be exercised by the scaler in making deductions for heart or star check (see Figure 20) as in many instances it is superficial and would be removed when the lumber is trimmed in a mill. In most instances it may be ignored.

Average diameter of check = 6"

$$\text{Volume of deduction} = \frac{6" \times 6" \times \text{estimated length}}{13}$$

Figure 20. Heart or star shake.

Patchy Rot

This situation is not uncommon in White Pine, and may be more scattered than in the diagram (see Figure 21).

Volume of defect = $\frac{6'' \times 5'' \times \text{estimated length}}{12}$

Figure 21. Patchy rot.

It may be necessary to block out the individual defects as follows:

$2'' \times 3'' = 6$ sq. in.
$2'' \times 2'' = 4$ sq. in.

Volume of defect = $\frac{10 \text{ sq. in.} \times \text{estimated length}}{12}$

When considering deductions for exterior defects the scaler should first determine whether or not the defect lies within the scaling cylinder. If outside, it can be ignored, but if any portion of the scaling cylinder is affected by the defect, due allowance must be made for it.

Defects in this category include:

a) lightning scars, gum seams and frost checks
b) scars at or near the butt resulting from log skidding, fire, etc.
c) scars resulting from porcupine chew and similar injuries
d) cankers
e) worm holes
f) heather char and bucking splits

In some instances it may be practical to use the diagram method, but more often a percent deduction of the gross volume is made for exterior defects.

Lightning Scars, gum exams and frost checks

These defects may extend straight along the length of the log or spiral around it.

The scaler, in making allowance for this type of defect, should take into consideration the depth of the scar, and the possibility of rot being associated with the injury. If it is a recent injury it may only be superficial.

In the example (see Figure 22) approximately 15% of the log is defective, therefore the net volume = 98 – 15 = 83 bd. ft., and as such could be tallied as a 10' log with a top diameter of 11" (83 bd. ft.).

Figure 06. Scars and exams

In the example (see Figure 23) the estimated defect is 20% of the gross volume of the log, therefore the net volume = 130 – 52 = 78 bd. ft. and the log could be tallied as a 10 log with a top diameter of 10" (78 bd.ft.).

Figure 06. Spiral sweep

Scar at or near the butt resulting from ice dribble, fire, etc. (see Figure 56)

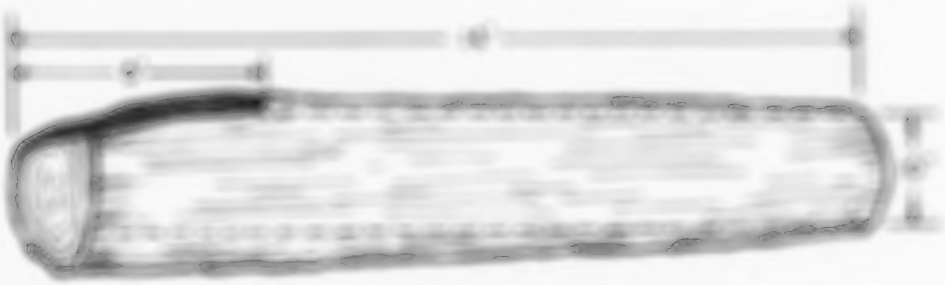


Figure 56. Scar at butt

Scars resulting from porcupine chew and similar injuries

The effect of porcupine scars or similar injuries can vary greatly depending on the extent of the injury, its location on the log and more particularly on its age. A tree may have been injured years ago with the result that the scar or scars will be quite deep. Recent scars often can be ignored, as they frequently have no effect on the scaling cylinder. Where allowance must be made, it can be done either by deducting cut, or in severe cases by reducing the diameter of the log.

Sweep

The usual procedure is to scale the sound portion inside the ring of sapwood (see Figure 57). If the sapwood is extensive the scaler should check to determine that it does not exceed 50% of the logs gross volume, otherwise it would be culled. Worm holes are often associated with sapwood.

Figure 58. Sapwood

Gross Scale: 12' log, 14" top diameter = 88 cu. ft.

Net Scale: 12' log, 12" top diameter = 70 cu. ft.

Worm Holes

These are usually associated with logs either cut from dead trees or logs that have been cut and left (during the summer) for a period of months.

Scalers should not be misled by bark borers, which usually restrict their activities to the area just beneath the bark. The occasional hole created by a wood borer is of little consequence but a number of such holes can be considered a defect.

Barber chair and bucking splits

Although the effect of these two are similar it is not unusual for the barber chair, unless severe, to be outside the scaling cylinder as it occurs on the butt log. The bucking split may be found between either the first and second log cut from a felled tree, or the second and third logs (see Figure 26). The resulting damage to the log may be allowed for either by blocking out or by reducing the length of the log.

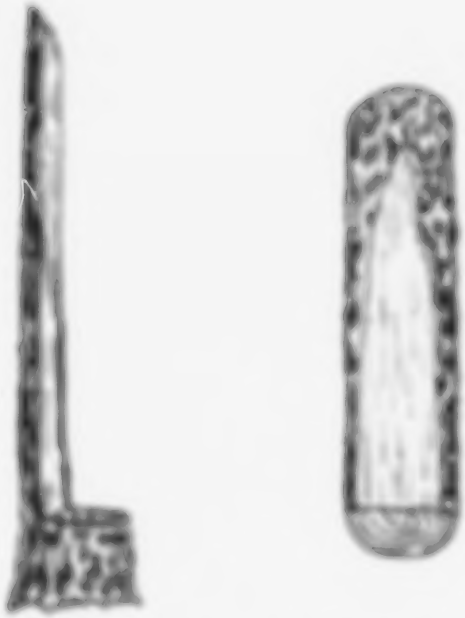


Figure 26. Barber chair and bucking split.

Defects of Form include:

a) sweep
b) crook
c) crotch or forked top

Sweep

Allowance for sweep may be made either by deducting a percent of the gross volume of the log (see Figure 27) or by a reduction in the log's length.

Example: A 16' log, with a 10" top diameter, has an estimated 25% sweep. Reduce the gross volume by 25% (16 bd. ft.) for a net scale of 48 bd. ft. In this case reduce the length by 4' so that a 12' log with a 10" top diameter would be tallied (48 bd. ft.).

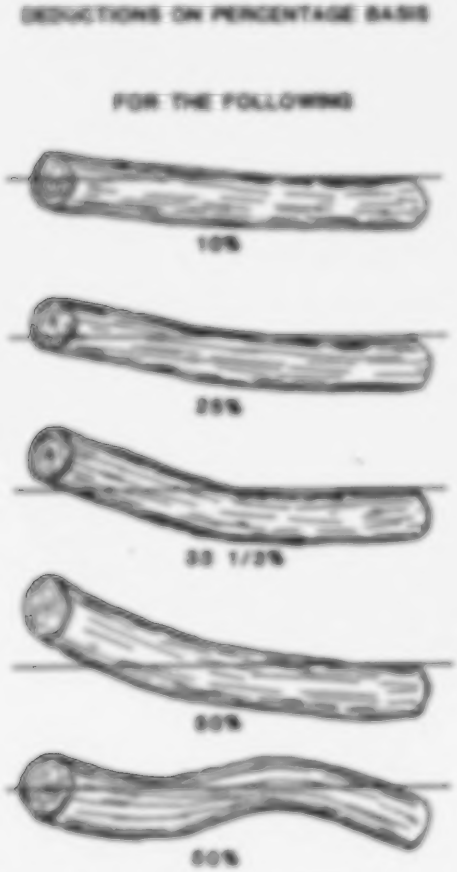


Figure 27. Sweep percentage deductions.

Crook

Crook is a defect that usually occurs at either end of the log. As a consequence it is common practice to allow for it by reducing the length of the log to the point where the crook begins (see Figure 28). It should be noted that crook at the butt can be deceiving if there is any amount of butt flare.

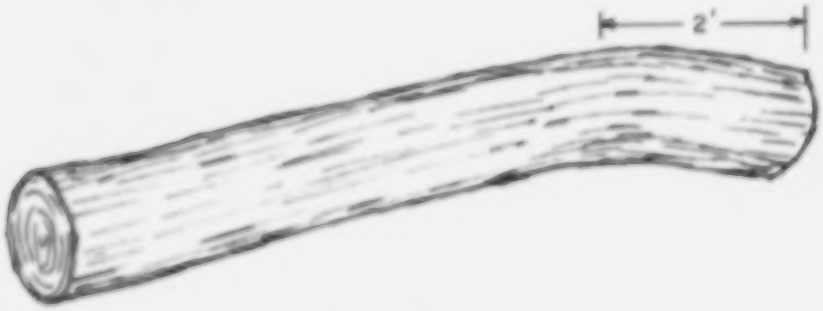


Figure 28. Crook.

Gross Scale: 12' log, 12" top diameter = 72 bd. ft.

Net Scale: 10' log, 12" top diameter = 60 bd. ft.

Crotch or Forked Top

The common practice, with this defect, is to reduce the length of the log by the length of the swollen portion (see Figure 29). Care should be exercised in the measurement of the top diameter and the scaler should check closely, to determine if there is any rot associated with the crotch.

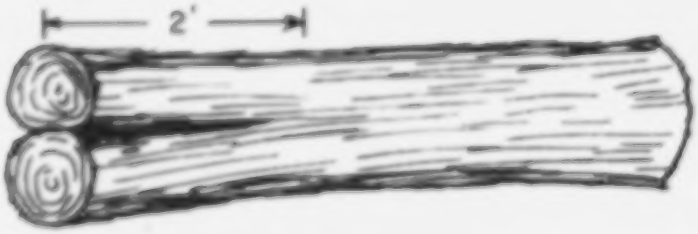


Figure 29. Crotch or forked top.

7. Developing Volume Tables and Conversion Factors

7.1 General

The development of volume tables and conversion factors is an aspect of scaling that requires sound sampling procedures and methodology coupled with good judgement and expertise of the scaler. The data that is compiled and formulated into tables and factors impacts greatly when applied on a large scale. Utmost care and attention must be applied by the scaler, to ensure a minimum of error.

This section of the manual will cover the current methodology and sampling practices acceptable to DNRE for use on Crown land. Any variation from these procedures must be approved by the Minister.

7.2 Smalians Formula

Note: where **V** appears in this section of the manual, it shall be with reference to volume (**V**), as determined by Smalians Formula.

Smalians Formula has been adopted for the means to calculate the gross volume of logs and / or sections of stems. The length is measured, as well as the end diameter(s), and the volume, in cubic metres, is computed directly. This formula is used extensively in the formation of volume tables and factors.

Cubic contents of logs or sections of stems, **V**, may be determined by applying Smalians formula, as follows:

$$V = \frac{A_1 + A_2}{2} \times L$$

where: V = volume of log, m^3
A = area of log ends (inside bark), m^2
L = length of log, m

Another variation of the formula may be used to further simplify the **V** calculation, where end diameters are measured in cm units.

$$V = A \times L$$

$$V = 0.00007854\ D^2 \times L$$

where V = volume of the piece in m^3
D = diameter of the bolt or log, inside bark, in cm units
L = the length of the bolt, half bolt, or log in m

Note : $\frac{L}{2}$ is used in place of L, when determining half bolt "**V**"

$0.00007854\ D^2$ is a constant, derived as follows:

Where A = a cross sectional area in m^2

$$A = \pi\ (D/2)^2$$

$$A = \frac{3.141\ 590\ D^2 / 4}{*10\ 000}$$

$$A = \frac{3.141\ 590\ D^2}{40\ 000}$$

$$A = 0.00007854\ D^2$$

π is a constant at 3.141 590

*10 000 is the divisor used to convert cm^2 to m^2, as scaled volumes are ultimately expressed in m^3

7.3 Stem Analysis

Stem analysis generally refers to the detailed measurement and volume determination of the gross merchantable portion of felled tree stems.

Volume results, determined through these procedures, may be used in treelength volume table construction, mass / volume relationships or other studies.

The procedures require outside bark measurements (o.b.), except for the small butt measurement. Compilation methodology accounts for bark thickness to generate solid wood content only.

The following procedures shall be followed for stem analysis data collection.

1. Sample stems must be placed on skids and adequate space must be left between sample stems to allow for accurate measuring.

2. Number each tree.

3. Mark a line perpendicular to the ground on the butt of each tree (or horizontal on the top side). This will ensure check scales are performed on the same axis.

4. For mass / volume relationship data collection, all stems, sections of stems and broken pieces of the sample must be measured (i.e. all volume must be accounted for).

5. On forked stems, one prong is considered as part of the main stem, and the other is marked to indicate a butt and is measured as an individual tree.

6. Measure total length, to nearest 0.1 m, from butt to the top or at a point where the tree is not less than 8.0 cm, outside bark.

7. If one end of the tree is broken leaving an irregular end surface, then the length is measured to the point where the first full diameter measurement is attainable by averaging the length of the broken section.

8. Measure the smallest butt diameter, or if tree is sectioned measure average diameter of large end inside bark in 2 cm classes.

9. Measure diameter outside bark at 0.5 m and 1.0 m. These are caliper measurements taken consistently, parallel to ground level.

10. Beyond 1.0 m, a diameter measurement is taken at increments of 2.0 m consistently to the last section. Diameter measurements are taken in 1.0 cm classes.

11. A diameter measurement is taken at the top, or at a point where the stem is not less than 8 cm (o.b.) and the length of the last section is recorded to the nearest 0.1 m.

12. Where bark is missing at the point of measurement, the diameter is adjusted, to reflect outside bark, by referring to a DNRE approved bark thickness table (Appendix S or T).

13. Volume is calculated by applying Smalians formula to each section of the stem (see Figure 30).

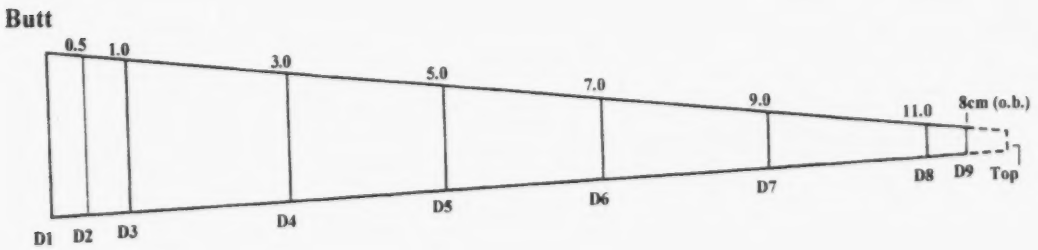


Figure 30. Stem analysis sections.

7.4 Calculating Rot Deductions

The NB Scaling General Regulation incorporate two methods for calculating rot deductions.

Stacked products, less than or equal to 2.60 m in length, have rot deductions calculated based on a cylinder shape. Rough wood factors are then applied, where deductions are made in m^3(st) (see Deductions m^3(st) section 3.2). The cylinder calculation is simply:

$$V(rot) = 0.00007854\ D^2 \times L$$

In the case of log deductions, a paraboloid cone shape is projected over the estimated length of the rot. A paraboloid cone shape can best be described as "bullet" shaped or a rounded cone. The calculation for this type of deduction is as follows:

$$V(rot) = \frac{0.00007854\ D^2 \times L}{2}$$

Note: A perfect cone calculation uses a divisor of "3"

These calculations are incorporated into NB Scaling Regulation Deduction Tables.

7.5 Developing Cull Factors

Cull factors (or rot factors) are required for construction of treelength volume tables and for development of treelength mass / volume relationships. A cull factor can be determined for a large population, such as a license, or for a much smaller population, such as a block or load. The measurement procedure is the same, however the required intensity and volume per sample may vary, based on how the data will be applied and the confidence level required. Intensity and sample size shall be specified in scaling arrangements or contracts.

The procedure for measuring and compiling cull factor data is as follows:

1. Determine intensity of sample and sample size based on application.
2. Lay treelength samples out on skids in the sample yard with work space between each stem of 1.0 m.
3. Determine a gross scale of the sample, through the stem analysis procedure (see Section 7.3).
4. After a gross scale of the sample has been determined each stem is evaluated for rot.
5. If a stem has rot showing at the butt, sections are slashed each metre until the stem sounds. The remainder of the stem is slashed for product unless more rot is suspected further along the stem. If so, further sectioning may be done to detect any additional rot.

6. Rot volumes are calculated for each one metre section with rot. These rot volumes are calculated, based on the same formula applied to log defect deductions. Where rot is present on both ends of the one metre section, the rot length is one metre. In this case, a deduction is made for each end of the one metre piece. Where rot is showing on one end only, the rot is assumed to extend half the bolt length or 0.5 metres.
7. The volume of the rot expressed as a percentage of the gross scale of the sample is the cull factor. Where several samples are combined, all rot is combined and expressed as a percentage of the total gross scale.
8. In cases where the cull factor will be applied to a mass / volume relationship, treelength pieces must first be longbutted to eliminate cull material.

7.6 Cube Scaling

The term "cube scaling" is used to define a technique whereby the solid cubic content of stacked primary forest products is determined and should not be confused with the term cubic metre scaling. Appendix "A" lists conversion factors, $m^3/m^3(st)$, for various products and length classes.

The solid cubic content, m^3, of stacked products varies for a number of reasons, the most significant being:

1. Length of the primary forest product
2. Species
3. Average diameter of the bolts
4. Quality of preparation (knots)
5. Product type
6. Number of products being cut from the tree
7. Piling
8. Foreign material in piles

It is important that conversion factors are accurate. When primary forest products are sold or purchased in stacked form, there is an assumed solid cubic content based on these factors.

The principles of "cubing" are the same for all stacked products, except for those products less than 2.44 m in length. In this case, measurements are only required on one side of the pile and length calculations are based on average bolt length, as opposed to half bolt lengths.

The steps to complete a "cubing exercise" are as follows:

Step 1: The solid content of every bolt in the pile is determined. This requires a diameter measurement of every bolt, on both sides of the pile. This will allow for gross solid content volume determination, based on projections of half-bolt volumes.

The diameter of each half-bolt is measured inside the bark by holding the scale stick in a consistent manner unless the bolt is out of round by 4 cm or more, in which case an average diameter is determined. The axis of the consistent scale stick measurements shall be recorded (ex. 45°). On butt ends with visible swell, the small butt diameter shall be recorded. In either case, the diameter is measured on a plane perpendicular to the longitudinal axis of the bolt in 2 cm units, the bolt is then marked to identify as tallied. If the diameter of a scaled piece coincides with the boundary between classes, that piece shall be measured and recorded as belonging to the lower class.

Once the diameter of every half bolt, on each side of the pile has been measured, they are totaled by diameter class, and multiplied by the volume per piece (1/2 bolt **V**) to determine total volume by diameter class. These volumes are totaled to determine the gross solid content of the pile. It is important to determine the average bolt length (and ½ bolt length) prior to compilation. Determine average bolt lengths (0.01 m) during taper adjustment, as follows.

A final adjustment shall be made to this gross solid content to account for taper, associated with butt pieces with visible swell. Without making this adjustment, solid volume may be overstated (or understated), as unadjusted calculations are based on perfectly even taper. This adjustment is referred to as a ***taper adjustment***.

The process to determine a taper adjustment is as follows:

Through a predetermined random selection process, identify a minimum of 15 pieces per sample for assessment (NOTE: These pieces must be within a normal length range, as approved by the Regional Inspector). These pieces, normally, situated on top of the pile, shall be individually measured for **V**. The individual piece volumes are totaled. Measure end diameters and lengths in 2 cm classes. End diameters shall be measured in the same manner applied to the sides of pile.

This process is repeated on the same pieces using the same dimension measurements, however on butt end pieces with visible swell, a second measurement is taken at 1 m from the butt. This measurement, (1 cm class), shall be taken outside bark with a bark thickness factor applied (Appendix S or T) to ensure the volume calculation accounts for solid wood only. **V** is determined again for the pieces. Piece volumes, on which 1m taper measurements were taken, shall be calculated as two sections (see Figure 31).

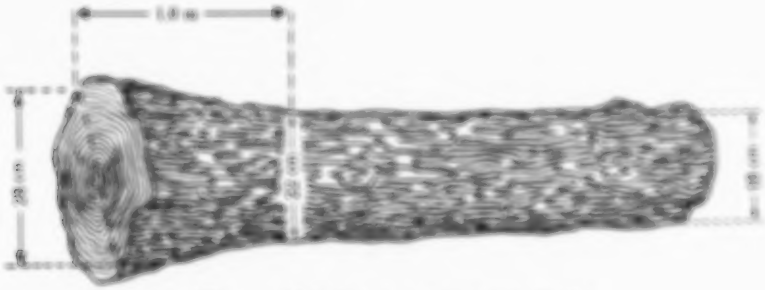


Figure 31. Taper measurement.

The taper adjustment factor is determined as follows:

$$\text{Taper Adjustment Factor} = \frac{\text{V of Pieces (taper measurements taken)}}{\text{V of Pieces (no taper measurements taken)}}$$

Example: A full truckload of Softwood Studwood is "cubed"
Taper adjustment assessment done on 20 pieces
V of 20 pieces (no taper measurements taken) = 0.960 m³
V of 20 pieces (taper measurements taken) = 0.944 m³

$$\text{Taper Adjustment Factor} = \frac{0.944\ m^3}{0.960\ m^3}$$

Taper Adjustment Factor = 0.983

The taper adjustment factor shall be multiplied against the gross solid content of the pile to determine the ***taper adjusted solid content.***

Step 2: The gross pile content in m³(st) is determined and calculated in exactly the same manner as described in Section 3.1. Diameters and deductions of voids are measured in exactly the same manner as described in Section 3.2.

For the purpose of "cube" scaling, no deductions are made for rot or cull bolts. All bolts, regardless of condition or presence of rot, occupy space.

Step 3: To determine the conversion factor, the following formula is applied:

$$\text{Conversion Factor} = \frac{\text{Taper Adjusted Solid Content of the Pile } m^3}{\text{Gross Pile Volume} - \text{Volume of Voids } m^3(st)}$$

Example: A pile of 2.50 m softwood pulpwood has been cube scaled.
Gross Pile Volume = 40.78 m³(st)
Volume of Void Deductions = 1.63 m³(st)
Taper Adjusted Solid Content of the Pile = 22.976 m³

Conversion Factor = $\frac{22.976\ m^3}{40.79 - 1.63\ m^3(st)}$

= 0.58869 m^3 / $m^3(st)$

Note: This factor is slightly higher than the 2.50 m softwood pulpwood factor in Appendix A. The Appendix A factors are provincial averages.

7.7 Developing Mass / Volume Relationships

Mass scaling of forest products is an approved method of measure providing procedures are approved by DNRE, for conversion of mass to volume units (m^3).

Mass may be converted to volume by:

1. Applying provincial standard mass / volume relationships.
2. Applying mass / volume relationships based on sampling procedures approved by DNRE.
3. Applying fixed factors based on historical sampling data, by operation, as approved by DNRE.
4. Applying a provincial standard mass / volume relationship, specific to bone dry mass, after determining moisture content (Chips).

The following **general procedures** shall apply for all mass / volume sampling of products harvested from Crown land.

- Sampling intensity (frequency) and sample load selection procedures are approved by DNRE in Scaling Arrangements, based on the estimated harvest volume by project or operation. Samples are identified by a predetermined random selection process, at a frequency based on number of loads or tonnes, as per Table 1.
- A designated section of the mill yard shall be identified as the sample area, which must be approved by the Regional Inspector.
- Skids are placed in sample area and all other timber including broken pieces must be removed before operation begins.

Table 1. Sample frequencies.

Project Volume m^3	Sample Frequency	
	Loads	Tonnes
5 000	5	175
10 000	10	350
15 000	15	525
20 000	20	700
25 000	25	875
30 000	30	1 050
40 000	40	1 400

- Loaded trucks are weighed and advised if a sample is to be removed. If a sample is to be taken, the truck then proceeds to sample area and unloads sample.
  a) The truck then returns to scales and is weighed again. The difference between the weight and the original weight is the mass of the sample, or;
  b) Another vehicle transports the sample to scales, is weighed and returns the sample. The empty vehicle is then re-weighed and the difference is the mass of the sample.
- Sample is placed on skids in a single tier with at least 1.0 m of clear space on all sides. Adequate room must be left between sample pieces to allow for accurate measuring.
- Each sample will contain a volume of not less than 3.0 m^3.
- Sample Number, Stock Number (full), and Transportation Certificate Number are attached to the first and last piece in each sample.
- Sample must remain intact for 48 hours after being scaled, except when scaled on Friday, Saturday or Sunday. These samples must remain intact for 72 hours.
- If sample results (kg/m^3) exceed a minimum or maximum range as per Table 2, then the sample must remain intact until released by a DNRE Check Scaler.
- In cases where mass is weighed in treelength form and volume is measured in product form, all pieces of the stem must be classified, measured and accounted for in the total volume calculation.

Table 2. Sample ranges (not factors).

Species	Summer				Winter			
	Min.		Max.		Min.		Max.	
	Logs[1]	M.T.[2]	Logs[1]	M.T.[2]	Logs[1]	M.T.[2]	Logs[1]	M.T.[2]
Species Fir, SP • Treestright • Log / Skid • Pulp	6(2) 6(0) 6(2)	1(.0)(3) 1(.0)(7) 1(.0)(3)	6(2) 6(0) 1(10)(3)	1(.0)(1) 1(.1)(1) 1(.0)(3)	7(0) 6(0) 7(0)	1(.0)(3) 1(.0)(8) 1(.0)(3)	1(0)(2) 1(0)(0) 1(1)(3)	1(.2)(3) 1(.0)(0) 1(.0)(3)
Mixed Hardwood	6(3)	1(.2)(3)	1(2)(3)	1(.3)(3)	6(2)	1(.2)(3)	1(2)(3)	1(.3)(3)
Poplar	7(3)	1(.3)(3)	1(1)(2)	1(.3)(3)	7(1)(2)	1(.3)(3)	1(1)(3)	1(.3)(1)

- In cases where an 'off species' piece is present in the sample, there are two options that can be applied:
  a) Include mass and volume of piece(s) in sample, if small quantities of 'off species' are representative of overall deliveries.
  b) Remove the piece(s) from both the mass and volume calculations. In this case the sample shall be reweighed after removing the 'off species'.
- Any data collected and blended to develop factors, by period, must be weighted (not averaged), by sample.
- Mass / volume factors may be applied to deliveries, by operation or project, under one of the following methods:
  a) apply within a defined pay period, based on sampling within pay period.
  b) accumulate sample data throughout operating season and adjust factor to end of current pay period, rebalancing for all previous loads.
  c) apply sample data for previous four weeks to current pay period (a rolling average).
  d) apply sample data for previous five samples to current pay period (a rolling average). If more than five samples are measured during pay period then all samples are used.
- All volume calculations must be compiled, in a manner consistent with this manual.
- Tally sheets, weight printouts, and mass / volume factor summaries must be retained for future reference. Copies shall be forwarded to the local DNRE office and / or Regional Inspector, as per approved Scaling Arrangements.

The following methods are approved for determining volume as applied to mass / volume relationships.

Method I – Stem Analysis

1. This method shall be used for volume determination of tree-length products.
2. Apply Stem Analysis procedures (see Section 7.3).
3. A cull factor (see Section 7.5), if applicable, shall be applied against the gross volume to determine the net volume. The net volume shall be applied to the mass / volume relationship.

Method II – Log Analysis

1. This method may be used for volume determination of log products that are greater in length than 5.00 m.
2. All logs, pieces and broken sections of the sample must be measured (i.e. all volume must be accounted for).
3. Number each log.
4. Mark a line perpendicular to the ground on the butt end of each log (or horizontal on the log deck).
5. Measure total length of log, to nearest 0.1 m.
6. The length of a piece shall be the distance between two planes perpendicular to the longitudinal axis of the piece and situated at the geometric center of the end faces.
7. The average diameter of the large end of each log is measured, inside bark, to 2 cm class. (In "butt" cut logs, the smallest butt diameter is measured).
8. Measure diameters, outside bark parallel to ground level, at 3.0 and 1.3 m, to 1 cm classes.
9. Measure diameters, outside bark, for the remaining length of the log to 1.3 m increments.
10. Measure diameter at the top end, outside bark, and record the length of the last section to the nearest 0.1 m.
11. Diameters are adjusted for any missing bark, using a DNRE approved bark thickness table (Appendix 9 or 11). Completion of cells above volume must account for bark thickness.

12. Solid wood volumes are calculated for each section of log (see Figure 32), as measured (ie. butt section, mid sections and top section).

13. Rot deductions will be applied consistent with the cubic metre log scale deduction table (Appendix L). No deductions are made for log form.

14. The gross solid wood volume of the logs minus rot deductions shall equal the net volume, which shall be applied to the mass / volume relationship.

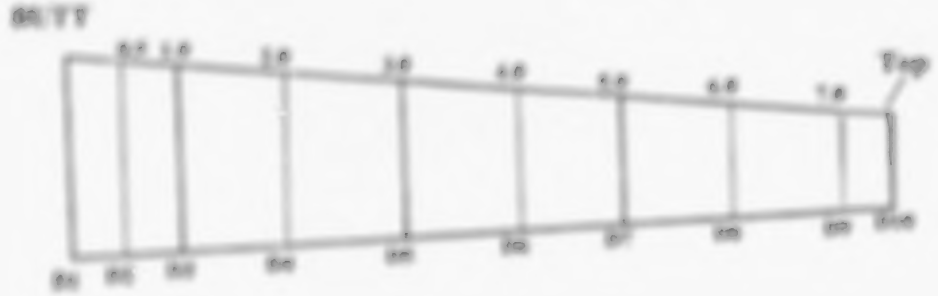


Figure 32. Log analysis sections.

Method III – Log / Pulp Sample

1. This method may be used for volume determination of pulp, studwood, OSB, or log products, regardless of length.

2. All pieces of the sample, including broken pieces must be measured (i.e. all volume must be accounted for).

3. Number each piece at one end.

4. A line shall be marked on each piece, either vertical on the end or horizontal on the top side to identify the position of the log on the skids.

5. The length of each log (or bolt) shall be measured (2 cm class).

6. The length of a piece shall be the distance between two planes perpendicular to the longitudinal axis of the piece and situated at the geometric center of the end faces.

7. If one end of the bolt is broken leaving an irregular end surface, the length is measured to the point where the first full diameter measurement is attainable, averaging the length of the broken section.

8. Diameters of both ends are measured on a plane perpendicular to the longitudinal axis of the piece (2 cm class).

9. Diameters are measured, inside bark, by holding the scale stick in a consistent manner unless the log is out of round by 4 cm or more, in which case an average diameter is determined. However, on butt cut pieces with visible swell, the smallest butt diameter shall be measured. The axis of the consistent scale stick measurements shall be recorded (ex. 45°).

10. An additional diameter will be measured at 1.0 m from butt, to incorporate a taper adjustment on butt cut pieces with visible swell. This caliper measurement will be taken parallel to ground level, unless the log is out of round by 4 cm or more, in which case, an average diameter is determined.

11. Taper diameters at 1.0 m will be measured in 1 cm classes.

12. Taper diameters at 1.0 m are taken outside bark and adjusted for any missing bark, using a DNRE approved bark thickness table (Appendix S or T). Compilation of solid wood volume must account for bark thickness.

13. For pulp, OSB, and studwood products, end diameters less than 8 cm class are measured and deducted as ½ bolt defects. Logs shall be measured to an 8 cm top.

14. For samples of pulp, OSB, and studwood products, rot deduction volumes shall be based on a cylindrical shape projected from the end rot diameter for the half bolt length. Rough wood factors are not applied. Reference Section 3.2, for defect measurement procedures.

15. For samples of all log products, rot deductions shall be made in a manner consistent with log deductions (see Appendix L). When rot exceeds 50% of gross volume, the log is culled and should not be included in volume compilations.

16. Deductions are not allowed for form defects.

17. Solid wood volumes are calculated for each piece based on end diameters and length measurements. Where taper measurements are taken, the piece volume is based on two sections (butt ⇒ 1.0 m and 1.0 m ⇒ top end). The gross taper adjusted solid volume of the sample minus rot deductions shall be the net taper adjusted volume. This volume shall be applied to the mass / volume relationship.

Method IV – Piled Sample

1. This method may be used for piled pulp, OSB, or studwood products (equal to or less than 2.60 m in length). Generally, a full truckload is piled down for measurement; however partial loads exceeding 8 m^3 may also be measured by this method.

2. Sample load intensity may be adjusted outside the frequency as per Table 1, at the discretion of the DNRE Regional Inspector.

3. Reference procedures for "*Cube Scaling, Section 7.6 – Step 1*" to determine the gross taper adjusted solid wood volume of the pile.

4. Rot deductions shall then be determined by measuring all rot defects on both sides of the pile. The rot deduction volumes shall be based on a cylindrical shape projected from the end rot diameter for the half bolt length. Rough wood factors are not applied. (note: reference Section 3.2 for defect measurement procedures).

5. The gross taper adjusted solid volume of the sample minus rot deduction volumes shall be the net taper adjusted volume. This volume shall be applied to the mass / volume relationship.

Method V - Water Displacement

This method may be used to measure any products, however current applications are restricted to pulp and OSB, less than 2.60 m in length.

Selected sample loads, held in a loader grapple, are immersed in a displacement tank equipped with an electronic level transmitter. The grapple is lowered into the water to a predetermined (marked) point on the grapple assembly.

The gross sample volume is equal to the measured displacement of water in m^3, minus displacement associated with grapple equipment (predetermined).

Following the displacement procedure, the sample is placed on skids to allow for measurement of rot (that displaces water) and undersize, as well as missing bark.

The gross sample volume is reduced by a bark percentage ratio, under procedures approved by DNRE.

Deductions for rot and undersize are determined by measurement procedures, as defined in Method III - Log / Pulp Sample, items 13 and 14 (for pulp and OSB products).

The gross sample volume minus deductions for bark, rot, and undersize shall be the net sample volume. This volume shall be applied to the mass / volume relationship.

Note: Procedures for Water Displacement sampling are under review. Consult with DNRE on current procedures, as required.

APPENDIX A

CONVERSION FACTORS / FACTEURS DE CONVERSION

PRODUCT/PRODUIT	LENGTH CLASS / CATÉGORIE DE LONGUEUR	$m^3/m^3(st)$ $m^3/m^3(app)$	** $m^3(st)/m^3$ $m^3(app)/m^3$
SOFTWOOD PULPWOOD / BOIS À PÂTE RÉSINEUX (except cedar / sauf le cèdre)	1.22 m (R/B)*	0.6641	1.5058
	2.50 m (R/B)	0.5836	1.7135
CEDAR SAWLOGS / BILLES DE CÈDRE	1.26 m (R/B)	0.6250	1.6000
	1.92 m (R/B)	0.5938	1.6841
	2.54 m (R/B)	0.5625	1.7778
MIXED HARDWOOD PULPWOOD / BOIS À PÂTE FEUILLU MÉLANGÉ (except poplar / sauf le peuplier)	1.22 m (R/B)	0.5469	1.8285
	2.50 m (R/B)	0.5078	1.9693
POPLAR PULPWOOD / BOIS À PÂTE DE PEUPLIER	1.22 m (R/B)	0.6641	1.5058
	2.50 m (R/B)	0.6094	1.6410
STUDWOOD/LATHWOOD / BOIS DE COLOMBAGE / LATTE DE BOIS	2.54 m (R/B)	0.6328	1.5803
LATHWOOD / LATTE DE BOIS	1.26 m (R/B)	0.6641	1.5058
SPOOLWOOD / BOIS À FUSEAUX (white birch/bouleau blanc)	1.26 m (R/B)	0.6641	1.5058
	2.54 m (R/B)	0.5836	1.7135
VENEER / BOIS À PLAQUER			
Softwood/résineux	2.60 m (R/B)	0.6855	1.4588
Poplar/peuplier	2.60 m (R/B)	0.6944	1.4401

* R = rough B = brut
** Rough Wood Factor / Facteur de conversion du bois brut

Above conversion factors are provincial averages /
Les facteurs de conversion ci-dessus sont les facteurs moyens utilisés dans la province

APPENDIX B

2.50 m ROUGH SOFTWOOD PULPWOOD / BOIS À PÂTE RÉSINEUX À L'ÉTAT BRUT DE 2,50 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.25 \times 1.713\ 5$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0,000\ 078\ 540)D^2 \times 1,25 \times 1,713\ 5$

TABLE SHOWING CONTENTS OF PULPWOOD BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 2.50 m Rough Softwood Pulpwood) /
TABLE MONTRANT LE CONTENU DES BILLOTS DE BOIS À PÂTE À L'ÉTAT BRUT
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois à pâte résineux empilé à l'état brut de 2,50 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.003	0.005	0.008	0.011	0.013	0.016	0.019	0.022	0.024	0.027
6	0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.055	0.061
8	0.011	0.022	0.032	0.043	0.054	0.065	0.075	0.086	0.097	0.108
10	0.017	0.034	0.050	0.067	0.084	0.101	0.118	0.135	0.151	0.168
12	0.024	0.048	0.073	0.097	0.121	0.145	0.170	0.194	0.218	0.242
14	0.033	0.066	0.099	0.132	0.165	0.198	0.231	0.264	0.297	0.330
16	0.043	0.086	0.129	0.172	0.215	0.258	0.301	0.345	0.388	0.431
18	0.055	0.109	0.164	0.218	0.273	0.327	0.382	0.436	0.491	0.545
20	0.067	0.135	0.202	0.269	0.336	0.404	0.471	0.538	0.606	0.673
22	0.081	0.163	0.244	0.326	0.407	0.489	0.570	0.651	0.733	0.814
24	0.097	0.194	0.291	0.388	0.484	0.581	0.678	0.775	0.872	0.969
26	0.114	0.227	0.341	0.455	0.569	0.682	0.796	0.910	1.023	1.137
28	0.132	0.264	0.396	0.528	0.659	0.791	0.923	1.055	1.187	1.319
30	0.151	0.303	0.454	0.606	0.757	0.908	1.060	1.211	1.363	1.514
32	0.172	0.345	0.516	0.689	0.861	1.034	1.206	1.378	1.550	1.723
34	0.194	0.389	0.583	0.779	0.972	1.167	1.361	1.556	1.750	1.945
36	0.218	0.436	0.654	0.872	1.090	1.308	1.526	1.744	1.962	2.180
38	0.243	0.486	0.729	0.972	1.214	1.457	1.700	1.943	2.186	2.429
40	0.269	0.538	0.807	1.077	1.346	1.615	1.884	2.153	2.422	2.692
42	0.297	0.593	0.890	1.187	1.484	1.780	2.077	2.374	2.671	2.967
44	0.326	0.651	0.977	1.303	1.628	1.954	2.280	2.605	2.931	3.257
46	0.356	0.712	1.068	1.424	1.780	2.136	2.492	2.848	3.204	3.560
48	0.388	0.775	1.163	1.550	1.938	2.326	2.713	3.101	3.488	3.876
50	0.421	0.841	1.262	1.682	2.103	2.523	2.944	3.364	3.785	4.206
52	0.455	0.910	1.365	1.819	2.274	2.729	3.184	3.639	4.094	4.549
54	0.491	0.981	1.472	1.962	2.453	2.943	3.434	3.924	4.415	4.905
56	0.528	1.055	1.583	2.110	2.638	3.165	3.693	4.220	4.748	5.275
58	0.566	1.132	1.698	2.264	2.830	3.395	3.961	4.527	5.093	5.659
60	0.606	1.211	1.817	2.422	3.028	3.634	4.239	4.845	5.450	6.056

APPENDIX C

2.50 m ROUGH MIXED HARDWOOD PULPWOOD / BOIS À PÂTE FEUILLU MÉLANGÉ
À L'ÉTAT BRUT DE 2,50 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.25 \times 1.969\ 3$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0,000\ 078\ 540)D^2 \times 1,25 \times 1,969\ 3$

TABLE SHOWING CONTENTS OF PULPWOOD BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 2.50 m Rough Mixed Hardwood Pulpwood) /
TABLE MONTRANT LE CONTENU DES BILLOTS DE BOIS PAR DIAMÈTRE
EN MÈTRES CUBES APPARENTS
(applicable au bois à pâte feuillu mélangé à l'état brut de 2,50 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.003	0.006	0.009	0.012	0.015	0.019	0.022	0.025	0.028	0.031
6	0.007	0.014	0.021	0.028	0.035	0.042	0.049	0.056	0.063	0.070
8	0.012	0.025	0.037	0.049	0.062	0.074	0.087	0.099	0.111	0.124
10	0.019	0.039	0.058	0.077	0.097	0.116	0.135	0.155	0.174	0.193
12	0.028	0.056	0.084	0.111	0.139	0.167	0.195	0.223	0.251	0.278
14	0.038	0.076	0.114	0.152	0.189	0.227	0.265	0.303	0.341	0.379
16	0.050	0.099	0.148	0.198	0.247	0.297	0.346	0.396	0.445	0.495
18	0.063	0.125	0.188	0.251	0.313	0.376	0.438	0.501	0.564	0.626
20	0.077	0.155	0.232	0.309	0.387	0.464	0.541	0.619	0.696	0.773
22	0.094	0.187	0.281	0.374	0.468	0.561	0.655	0.749	0.842	0.936
24	0.111	0.223	0.334	0.445	0.557	0.668	0.780	0.891	1.002	1.114
26	0.131	0.261	0.392	0.523	0.653	0.784	0.915	1.046	1.176	1.307
28	0.152	0.303	0.455	0.606	0.758	0.909	1.061	1.213	1.364	1.516
30	0.174	0.348	0.522	0.696	0.870	1.044	1.218	1.392	1.566	1.740
32	0.198	0.396	0.594	0.792	0.990	1.188	1.386	1.584	1.782	1.980
34	0.223	0.447	0.670	0.894	1.117	1.341	1.564	1.788	2.011	2.235
36	0.251	0.501	0.752	1.002	1.253	1.503	1.754	2.005	2.255	2.506
38	0.279	0.558	0.838	1.117	1.396	1.675	1.954	2.233	2.513	2.792
40	0.309	0.619	0.928	1.237	1.547	1.856	2.165	2.474	2.784	3.093
42	0.341	0.682	1.023	1.364	1.705	2.046	2.387	2.728	3.069	3.410
44	0.374	0.749	1.123	1.497	1.871	2.246	2.620	2.994	3.369	3.743
46	0.409	0.818	1.227	1.636	2.045	2.455	2.863	3.273	3.682	4.091
48	0.445	0.891	1.336	1.782	2.227	2.673	3.118	3.564	4.009	4.454
50	0.483	0.967	1.450	1.933	2.417	2.900	3.383	3.867	4.350	4.833
52	0.523	1.046	1.568	2.091	2.614	3.137	3.659	4.182	4.705	5.228
54	0.564	1.128	1.691	2.255	2.819	3.383	3.946	4.510	5.074	5.638
56	0.606	1.213	1.819	2.425	3.032	3.638	4.244	4.850	5.457	6.063
58	0.650	1.301	1.951	2.602	3.252	3.902	4.553	5.203	5.853	6.504
60	0.696	1.392	2.088	2.784	3.480	4.176	4.872	5.568	6.264	6.960

APPENDIX D

2.54 m ROUGH CEDAR STUDWOOD / BOIS DE COLOMBAGE DE CÈDRE À L'ÉTAT BRUT DE 2,54 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.27 \times 1.7778$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0,000\ 078\ 540)D^2 \times 1,27 \times 1,7778$

TABLE SHOWING CONTENTS OF STUDWOOD BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 2.54 m Rough Cedar Studwood) /
TABLEAU MONTRANT LE CONTENU DE BOIS DE COLOMBAGE À L'ÉTAT BRUT
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois de colombage de cèdre empilé à l'état brut de 2,54 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.003	0.006	0.009	0.011	0.014	0.017	0.020	0.023	0.026	0.028
6	0.006	0.013	0.019	0.026	0.032	0.038	0.045	0.051	0.057	0.064
8	0.011	0.023	0.034	0.045	0.057	0.068	0.079	0.091	0.102	0.113
10	0.018	0.035	0.053	0.071	0.089	0.106	0.124	0.142	0.160	0.177
12	0.026	0.051	0.077	0.102	0.128	0.153	0.179	0.204	0.230	0.255
14	0.035	0.070	0.104	0.139	0.174	0.209	0.243	0.278	0.313	0.348
16	0.045	0.091	0.136	0.182	0.227	0.272	0.318	0.363	0.409	0.454
18	0.057	0.115	0.172	0.230	0.287	0.345	0.402	0.460	0.517	0.575
20	0.071	0.142	0.213	0.284	0.355	0.426	0.497	0.567	0.638	0.709
22	0.086	0.172	0.257	0.343	0.429	0.515	0.601	0.687	0.772	0.858
24	0.102	0.204	0.306	0.409	0.511	0.613	0.715	0.817	0.919	1.021
26	0.120	0.240	0.360	0.480	0.599	0.719	0.839	0.959	1.079	1.199
28	0.139	0.278	0.417	0.556	0.695	0.834	0.973	1.112	1.251	1.390
30	0.160	0.319	0.479	0.638	0.798	0.958	1.117	1.277	1.436	1.596
32	0.182	0.363	0.545	0.726	0.908	1.090	1.271	1.453	1.634	1.816
34	0.205	0.410	0.615	0.820	1.025	1.230	1.435	1.640	1.845	2.050
36	0.230	0.460	0.689	0.919	1.149	1.379	1.609	1.839	2.068	2.298
38	0.256	0.512	0.768	1.024	1.280	1.536	1.792	2.048	2.305	2.561
40	0.284	0.567	0.851	1.135	1.419	1.702	1.986	2.270	2.554	2.837
42	0.313	0.626	0.938	1.251	1.564	1.877	2.190	2.502	2.815	3.128
44	0.343	0.687	1.030	1.373	1.717	2.060	2.403	2.746	3.090	3.433
46	0.375	0.750	1.126	1.501	1.876	2.251	2.627	3.002	3.377	3.752
48	0.409	0.817	1.226	1.634	2.043	2.451	2.860	3.269	3.677	4.086
50	0.443	0.887	1.330	1.773	2.217	2.660	3.103	3.547	3.990	4.433
52	0.480	0.959	1.438	1.918	2.397	2.877	3.356	3.836	4.315	4.795
54	0.517	1.034	1.551	2.068	2.585	3.103	3.620	4.137	4.654	5.171
56	0.556	1.112	1.668	2.224	2.781	3.337	3.893	4.449	5.005	5.561
58	0.597	1.193	1.790	2.386	2.983	3.579	4.176	4.772	5.369	5.965
60	0.638	1.277	1.915	2.554	3.192	3.830	4.469	5.107	5.745	6.384

APPENDIX E

1.22 m ROUGH SOFTWOOD PULPWOOD / BOIS À PÂTE DE RÉSINEUX À L'ÉTAT BRUT DE 1,22 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.22 \times 1.505\ 8$
Formule: $m^3(app) =$ A x L x Facteur de conversion du bois brut
$= (0{,}000\ 078\ 540)D^2 \times 1{,}22 \times 1{,}505\ 8$

TABLE SHOWING CONTENTS OF PULPWOOD BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 1.22 m Rough Softwood Pulpwood) /
TABLEAU MONTRANT LE CONTENU DES BILLOTS DE BOIS À PÂTE À L'ÉTAT BRUT
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois à pâte résineux empilé à l'état brut de 1,22 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.002	0.005	0.007	0.009	0.012	0.014	0.016	0.018	0.021	0.023
6	0.005	0.010	0.016	0.021	0.026	0.031	0.036	0.042	0.047	0.052
8	0.009	0.018	0.028	0.037	0.046	0.055	0.064	0.074	0.083	0.092
10	0.014	0.029	0.043	0.058	0.072	0.086	0.101	0.115	0.130	0.144
12	0.021	0.042	0.062	0.083	0.104	0.125	0.146	0.166	0.187	0.208
14	0.028	0.057	0.085	0.113	0.142	0.170	0.198	0.226	0.255	0.283
16	0.037	0.074	0.111	0.148	0.184	0.221	0.258	0.295	0.332	0.369
18	0.047	0.093	0.140	0.187	0.234	0.280	0.327	0.374	0.420	0.467
20	0.058	0.115	0.173	0.231	0.288	0.346	0.404	0.462	0.519	0.577
22	0.070	0.140	0.209	0.279	0.349	0.419	0.489	0.558	0.628	0.698
24	0.083	0.166	0.249	0.332	0.416	0.499	0.582	0.665	0.748	0.831
26	0.098	0.195	0.292	0.390	0.488	0.585	0.682	0.780	0.878	0.975
28	0.113	0.226	0.339	0.452	0.566	0.679	0.792	0.905	1.018	1.131
30	0.130	0.260	0.390	0.520	0.650	0.779	0.909	1.039	1.169	1.299
32	0.148	0.295	0.443	0.591	0.738	0.886	1.034	1.182	1.329	1.477
34	0.167	0.334	0.500	0.667	0.834	1.001	1.168	1.334	1.501	1.668
36	0.187	0.374	0.561	0.748	0.935	1.122	1.309	1.496	1.683	1.870
38	0.208	0.417	0.625	0.833	1.042	1.250	1.458	1.666	1.875	2.083
40	0.231	0.462	0.693	0.924	1.154	1.385	1.616	1.847	2.078	2.309
42	0.254	0.509	0.764	1.018	1.272	1.527	1.782	2.036	2.290	2.545
44	0.279	0.559	0.838	1.117	1.396	1.676	1.955	2.234	2.514	2.793
46	0.305	0.611	0.916	1.221	1.526	1.832	2.137	2.442	2.748	3.053
48	0.332	0.665	0.997	1.330	1.662	1.994	2.327	2.659	2.992	3.324
50	0.361	0.721	1.082	1.443	1.804	2.164	2.525	2.886	3.246	3.607
52	0.390	0.780	1.170	1.560	1.950	2.341	2.731	3.121	3.511	3.901
54	0.421	0.841	1.262	1.683	2.104	2.524	2.945	3.366	3.786	4.207
56	0.452	0.905	1.358	1.810	2.262	2.715	3.168	3.620	4.072	4.525
58	0.485	0.971	1.456	1.942	2.427	2.912	3.398	3.883	4.369	4.854
60	0.519	1.039	1.558	2.078	2.597	3.116	3.636	4.155	4.675	5.194

APPENDIX F

2.50 m ROUGH POPLAR PULPWOOD / BOIS À PÂTE DE PEUPLIER À L'ÉTAT BRUT DE 2,50 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\,078\,540)D^2 \times 1.25 \times 1.6410$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0,000\,078\,540)D^2 \times 1,25 \times 1,6410$

TABLE SHOWING CONTENTS OF PULPWOOD BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 2.50 m Rough Poplar Pulpwood) /
TABLEAU MONTRANT LE CONTENU DES BILLOTS DE BOIS À PÂTE À L'ÉTAT BRUT
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois à pâte de peuplier empilé à l'état brut de 2,50 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.003	0.005	0.008	0.010	0.013	0.015	0.018	0.021	0.023	0.026
6	0.006	0.012	0.017	0.023	0.029	0.035	0.041	0.046	0.052	0.058
8	0.010	0.021	0.031	0.041	0.052	0.062	0.072	0.082	0.093	0.103
10	0.016	0.032	0.048	0.064	0.081	0.097	0.113	0.129	0.145	0.161
12	0.023	0.046	0.070	0.093	0.116	0.139	0.162	0.186	0.209	0.232
14	0.032	0.063	0.095	0.126	0.158	0.189	0.221	0.253	0.284	0.316
16	0.041	0.082	0.124	0.165	0.206	0.247	0.289	0.330	0.371	0.412
18	0.052	0.104	0.157	0.209	0.261	0.313	0.365	0.418	0.470	0.522
20	0.064	0.129	0.193	0.258	0.322	0.387	0.451	0.516	0.580	0.644
22	0.078	0.156	0.234	0.312	0.390	0.468	0.546	0.624	0.702	0.780
24	0.093	0.186	0.278	0.371	0.464	0.557	0.650	0.742	0.835	0.928
26	0.108	0.218	0.327	0.436	0.545	0.653	0.762	0.871	0.980	1.089
28	0.126	0.253	0.379	0.505	0.632	0.758	0.884	1.010	1.137	1.263
30	0.145	0.290	0.435	0.580	0.725	0.870	1.015	1.160	1.305	1.450
32	0.165	0.330	0.495	0.660	0.825	0.990	1.155	1.320	1.485	1.650
34	0.186	0.372	0.559	0.745	0.931	1.117	1.304	1.490	1.676	1.862
36	0.209	0.418	0.626	0.835	1.044	1.253	1.462	1.670	1.879	2.088
38	0.233	0.465	0.698	0.931	1.163	1.396	1.628	1.861	2.094	2.326
40	0.258	0.516	0.773	1.031	1.289	1.547	1.804	2.062	2.320	2.578
42	0.284	0.568	0.853	1.137	1.421	1.705	1.989	2.274	2.558	2.842
44	0.312	0.624	0.936	1.248	1.559	1.871	2.183	2.495	2.807	3.119
46	0.341	0.682	1.023	1.364	1.704	2.045	2.386	2.727	3.068	3.409
48	0.371	0.742	1.114	1.485	1.856	2.227	2.598	2.969	3.341	3.712
50	0.403	0.806	1.208	1.611	2.014	2.417	2.819	3.222	3.625	4.028
52	0.436	0.871	1.307	1.743	2.178	2.614	3.049	3.485	3.921	4.356
54	0.470	0.940	1.409	1.879	2.349	2.819	3.289	3.758	4.228	4.698
56	0.505	1.010	1.516	2.021	2.526	3.031	3.537	4.042	4.547	5.052
58	0.542	1.084	1.626	2.168	2.710	3.252	3.794	4.336	4.878	5.420
60	0.580	1.160	1.740	2.320	2.900	3.480	4.060	4.640	5.220	5.800

APPENDIX G

1.22 m ROUGH MIXED HARDWOOD PULPWOOD / BOIS À PÂTE FEUILLU MÉLANGÉ À L'ÉTAT BRUT DE 1,22 m

Formula: m^3(ub) = A x L x Rough Wood Factor
= (0.000 078 5401)D^2 x 1.22 x 1.828 5
Formula: m^3(app) = A x L x Facteur de conversion du bois brut
= (0,000 078 5401)D^2 x 1,22 x 1,828 5

TABLE SHOWING CONTENTS OF PULPWOOD BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 1.22 m Rough Wood Hardwood Pulpwood)
TABLE MONTRANT LE CONTENU DES BILLOTS DE BOIS PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois à pâte feuillu mélangé à l'état brut de 1,22 m)

Diameter of Debut or Small Diameter of debitage ou de l'espace wide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.003	0.006	0.008	0.011	0.014	0.017	0.020	0.022	0.025	0.028
6	0.006	0.013	0.019	0.025	0.032	0.038	0.044	0.050	0.057	0.063
8	0.011	0.022	0.034	0.045	0.056	0.067	0.078	0.090	0.101	0.112
10	0.018	0.035	0.053	0.070	0.088	0.105	0.123	0.140	0.158	0.175
12	0.025	0.050	0.076	0.101	0.126	0.151	0.177	0.202	0.227	0.252
14	0.034	0.069	0.103	0.137	0.172	0.206	0.240	0.275	0.309	0.343
16	0.045	0.090	0.135	0.179	0.224	0.269	0.314	0.359	0.404	0.449
18	0.057	0.114	0.170	0.227	0.284	0.341	0.398	0.454	0.511	0.568
20	0.070	0.140	0.210	0.280	0.350	0.420	0.491	0.561	0.631	0.701
22	0.085	0.170	0.254	0.339	0.424	0.509	0.594	0.678	0.763	0.848
24	0.101	0.202	0.303	0.404	0.504	0.606	0.706	0.807	0.908	1.009
26	0.118	0.237	0.355	0.474	0.592	0.711	0.829	0.948	1.066	1.184
28	0.137	0.275	0.412	0.549	0.687	0.824	0.962	1.099	1.236	1.374
30	0.158	0.315	0.473	0.631	0.788	0.946	1.104	1.262	1.419	1.577
32	0.179	0.359	0.538	0.718	0.897	1.076	1.256	1.435	1.615	1.794
34	0.202	0.405	0.608	0.810	1.013	1.215	1.418	1.620	1.823	2.025
36	0.227	0.454	0.681	0.908	1.135	1.362	1.590	1.816	2.044	2.271
38	0.253	0.506	0.759	1.012	1.265	1.518	1.771	2.024	2.277	2.530
40	0.280	0.561	0.841	1.121	1.402	1.682	1.962	2.243	2.523	2.803
42	0.309	0.618	0.927	1.236	1.545	1.854	2.163	2.472	2.782	3.091
44	0.339	0.678	1.018	1.357	1.696	2.035	2.374	2.714	3.053	3.392
46	0.371	0.742	1.112	1.483	1.854	2.224	2.595	2.966	3.337	3.707
48	0.404	0.807	1.211	1.615	2.019	2.422	2.826	3.229	3.633	4.037
50	0.438	0.876	1.314	1.752	2.190	2.628	3.066	3.504	3.942	4.380
52	0.474	0.948	1.421	1.895	2.369	2.842	3.316	3.790	4.264	4.738
54	0.511	1.022	1.533	2.044	2.554	3.065	3.576	4.087	4.598	5.109
56	0.549	1.099	1.648	2.198	2.747	3.297	3.846	4.396	4.945	5.494
58	0.589	1.179	1.768	2.358	2.947	3.536	4.126	4.715	5.304	5.894
60	0.631	1.262	1.892	2.523	3.154	3.784	4.415	5.046	5.677	6.307

APPENDIX N

NEW BRUNSWICK SCRIBNER QUARTER VOLUME TABLE
MESURE EN METRES CUBES DE BOIS RESSORTIS DU NOUVEAU-BRUNSWICK

STUMP HEIGHT	LOG LENGTH / LONGUEUR DES BILLES 0.2 m units / unités de 0.2 m															
	10.2 m 33 ft	10.0 m 33 ft	9.8 m 32 ft	9.6 m 31 ft	9.4 m 30 ft	9.2 m 30 ft	9.0 m 29 ft	8.8 m 29 ft	8.6 m 28 ft	8.4 m 28 ft	8.2 m 26 ft	8.0 m 26 ft	7.8 m 25 ft	7.6 m 25 ft	7.4 m 24 ft	7.2 m 24 ft
	5	4	3	2	1	0	11	10	9	8	7	6	5	4	3	2
0	0.087	0.089	0.091	0.093	0.095	0.097	0.099	0.101	0.103	0.105	0.107	0.109	0.111	0.113	0.115	0.117
10	0.093	0.095	0.097	0.099	0.101	0.103	0.105	0.107	0.109	0.111	0.113	0.115	0.117	0.119	0.121	0.123
12	0.099	0.101	0.103	0.105	0.107	0.109	0.111	0.113	0.115	0.117	0.119	0.121	0.123	0.125	0.127	0.130
14	0.105	0.107	0.109	0.111	0.113	0.115	0.117	0.119	0.121	0.123	0.125	0.128	0.130	0.132	0.134	0.136
16	0.111	0.113	0.115	0.117	0.119	0.121	0.123	0.125	0.128	0.130	0.132	0.134	0.136	0.138	0.140	0.142
18	0.117	0.119	0.121	0.123	0.125	0.127	0.130	0.132	0.134	0.136	0.138	0.140	0.142	0.144	0.146	0.148
20	0.123	0.125	0.127	0.130	0.132	0.134	0.136	0.138	0.140	0.142	0.144	0.146	0.148	0.150	0.152	0.154
22	0.129	0.131	0.134	0.136	0.138	0.140	0.142	0.144	0.146	0.148	0.150	0.152	0.154	0.156	0.158	0.160
24	0.135	0.138	0.140	0.142	0.144	0.146	0.148	0.150	0.152	0.154	0.156	0.158	0.160	0.162	0.164	0.166
26	0.142	0.144	0.146	0.148	0.150	0.152	0.154	0.156	0.158	0.160	0.162	0.164	0.166	0.168	0.170	0.172
28	0.148	0.150	0.152	0.154	0.156	0.158	0.160	0.162	0.164	0.166	0.168	0.170	0.172	0.174	0.176	0.178
30	0.154	0.156	0.158	0.160	0.162	0.164	0.166	0.168	0.170	0.172	0.174	0.176	0.178	0.180	0.182	0.184
32	0.160	0.162	0.164	0.166	0.168	0.170	0.172	0.174	0.176	0.178	0.180	0.182	0.184	0.186	0.188	0.190
34	0.166	0.168	0.170	0.172	0.174	0.176	0.178	0.180	0.182	0.184	0.186	0.188	0.190	0.192	0.194	0.196
36	0.172	0.174	0.176	0.178	0.180	0.182	0.184	0.186	0.188	0.190	0.192	0.194	0.196	0.198	0.200	0.202
38	0.178	0.180	0.182	0.184	0.186	0.188	0.190	0.192	0.194	0.196	0.198	0.200	0.202	0.204	0.206	0.208
40	0.184	0.186	0.188	0.190	0.192	0.194	0.196	0.198	0.200	0.202	0.204	0.206	0.208	0.210	0.212	0.214
42	0.190	0.192	0.194	0.196	0.198	0.200	0.202	0.204	0.206	0.208	0.210	0.212	0.214	0.216	0.218	0.220
44	0.196	0.198	0.200	0.202	0.204	0.206	0.208	0.210	0.212	0.214	0.216	0.218	0.220	0.222	0.224	0.226
46	0.202	0.204	0.206	0.208	0.210	0.212	0.214	0.216	0.218	0.220	0.222	0.224	0.226	0.228	0.230	0.232
48	0.208	0.210	0.212	0.214	0.216	0.218	0.220	0.222	0.224	0.226	0.228	0.230	0.232	0.234	0.236	0.238
50	0.214	0.216	0.218	0.220	0.222	0.224	0.226	0.228	0.230	0.232	0.234	0.236	0.238	0.240	0.242	0.244
52	0.220	0.222	0.224	0.226	0.228	0.230	0.232	0.234	0.236	0.238	0.240	0.242	0.244	0.246	0.248	0.250
54	0.226	0.228	0.230	0.232	0.234	0.236	0.238	0.240	0.242	0.244	0.246	0.248	0.250	0.252	0.254	0.256
56	0.232	0.234	0.236	0.238	0.240	0.242	0.244	0.246	0.248	0.250	0.252	0.254	0.256	0.258	0.260	0.262
58	0.238	0.240	0.242	0.244	0.246	0.248	0.250	0.252	0.254	0.256	0.258	0.260	0.262	0.264	0.266	0.268
60	0.244	0.246	0.248	0.250	0.252	0.254	0.256	0.258	0.260	0.262	0.264	0.266	0.268	0.270	0.272	0.274
62	0.250	0.252	0.254	0.256	0.258	0.260	0.262	0.264	0.266	0.268	0.270	0.272	0.274	0.276	0.278	0.280
64	0.256	0.258	0.260	0.262	0.264	0.266	0.268	0.270	0.272	0.274	0.276	0.278	0.280	0.282	0.284	0.286
66	0.262	0.264	0.266	0.268	0.270	0.272	0.274	0.276	0.278	0.280	0.282	0.284	0.286	0.288	0.290	0.292
68	0.268	0.270	0.272	0.274	0.276	0.278	0.280	0.282	0.284	0.286	0.288	0.290	0.292	0.294	0.296	0.298
70	0.274	0.276	0.278	0.280	0.282	0.284	0.286	0.288	0.290	0.292	0.294	0.296	0.298	0.300	0.302	0.304
72	0.280	0.282	0.284	0.286	0.288	0.290	0.292	0.294	0.296	0.298	0.300	0.302	0.304	0.306	0.308	0.310
74	0.286	0.288	0.290	0.292	0.294	0.296	0.298	0.300	0.302	0.304	0.306	0.308	0.310	0.312	0.314	0.316
76	0.292	0.294	0.296	0.298	0.300	0.302	0.304	0.306	0.308	0.310	0.312	0.314	0.316	0.318	0.320	0.322
78	0.298	0.300	0.302	0.304	0.306	0.308	0.310	0.312	0.314	0.316	0.318	0.320	0.322	0.324	0.326	0.328
80	0.304	0.306	0.308	0.310	0.312	0.314	0.316	0.318	0.320	0.322	0.324	0.326	0.328	0.330	0.332	0.334

* STUMP - engelure ou diamètre - HEIGHT - plus ou moins le ou plus bas
> - means greater than - signifie supérieur à
< - means less than or equal to - signifie inférieur ou égal à

APPENDIX I

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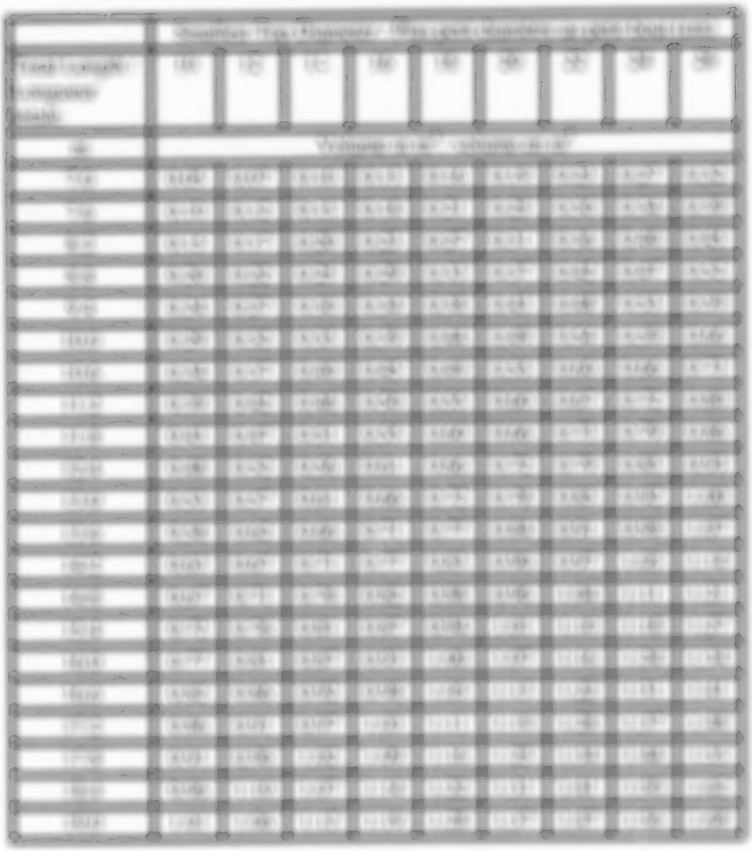
APPENDIX J



APPENDIX A

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APPENDIX L

Formula $m^3 = (0.000 079 \, 5)(\pi)(D)^2 \times L^2$ — L – Length of defect /
Formula $m^3 = (0.000 079 \, 5)(\pi)(D)^2 \times L^2$ — L – Longueur du défaut

Average diameter / Diamètre moyen	Length of defect / Longueur du défaut										
	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
cm	Volume in m^3 / Volume en m^3										
8	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
9	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
11	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
12	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
13	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
14	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
15	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
16	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
17	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
18	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
19	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
20	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
21	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
22	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
23	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
24	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
25	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
26	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
27	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
28	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
30	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
31	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
32	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
33	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
34	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
35	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
36	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
37	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
38	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
39	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
40	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

NOTE:

(a) When the defect does not extend the full length of the log, deductions shall be calculated as follows:

(1) determine the average diameter of the defect;
(2) length of defect shall be rounded to the nearest 0.5 m unit;
(3) refer to the table for the volume to be deducted from the gross volume of the log.

(b) When the defect extends the full length of the log, deductions shall be calculated as follows: Length of defect shall be rounded to a 0.5 m unit; where the length of the defect is greater than the length of the log, the defect length shall be reduced by 0.5 m;

(1) determine the average diameter of the defect at the butt end of the log;
(2) refer to the table to determine the deduction to be made for the defect at the butt;
(3) determine the average diameter of the defect at the top end of the log;
(4) refer to the table to determine the deduction to be made for the defect at the top;
(5) the volume determined in steps 2 and 4 are added together. This value is the total deduction to be made for the defect.

NOTE:

(a) Lorsque le défaut est limité à une partie de la bille, les déductions sont calculées comme suit :

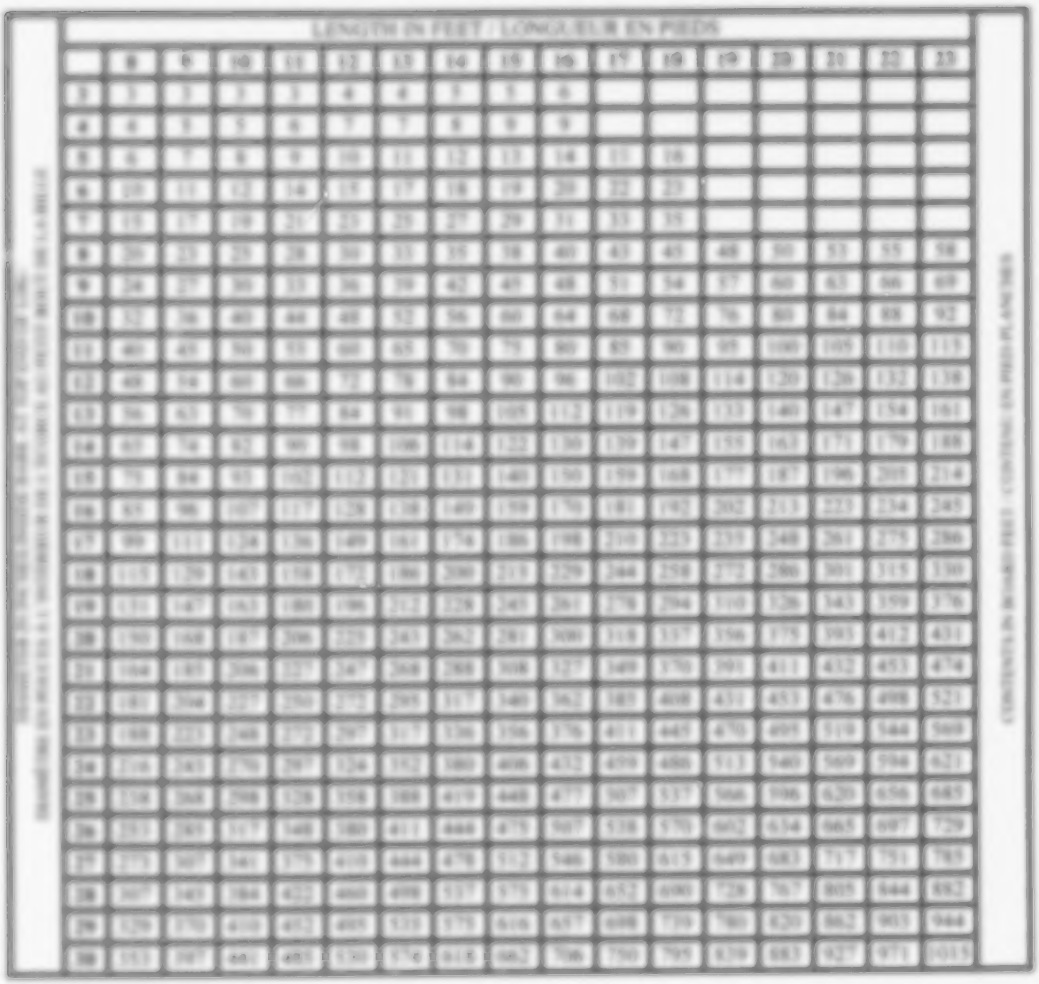
(1) déterminer le diamètre moyen du défaut;
(2) arrondir la longueur du défaut à l'unité de 0,5 m près;
(3) se référer à la table pour avoir le volume à déduire du volume brut de la bille.

(b) Lorsque le défaut s'étend à toute la longueur de la bille, les déductions sont calculées comme suit : La longueur du défaut est arrondie à l'unité de 0,5 m; lorsque la longueur du défaut est supérieure à la longueur de la bille, la longueur du défaut est réduite de 0,5 m;

(1) déterminer le diamètre moyen du défaut au gros bout de la bille;
(2) se référer à la table pour déterminer les déductions à faire pour le défaut au gros bout;
(3) déterminer le diamètre moyen du défaut au petit bout de la bille;
(4) se référer de la table pour déterminer la déduction à faire pour le défaut au petit bout;
(5) additionner les résultats déterminés aux phases 2 et 4 pour obtenir la déduction totale à faire pour le défaut.

APPENDIX M

NEW BRUNSWICK LOG SCALE / MESURE DE BOIS DU NOUVEAU-BRUNSWICK



APPENDIX N

LIMITS OF ERROR OF TAPES/TOLÉRANCES POUR LES RUBANS

Indicated Length/ Longueur indiquée	Limits of Error Over or Under Indicated Length/ Tolérances en + ou en - par rapport à la longueur indiquée
m	mm
0.2	0.2
1	0.6
3	1.5
10	3
20	4
30	5.5

APPENDIX O

2.54 m ROUGH STUDWOOD, LATHWOOD / BOIS DE COLOMBAGE, LATTE DE BOIS À L'ÉTAT BRUT DE 2,54 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.27 \times 1.5803$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0,000\ 078\ 540)D^2 \times 1,27 \times 1,5803$

TABLE SHOWING CONTENTS OF STUDWOOD AND LATHWOOD BOLTS
BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 2.54 m Rough Studwood and Lathwood) /
TABLEAU MONTRANT LE CONTENU DES BILLOTS DE BOIS COLOMBAGE ET LATTE DE BOIS
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois de colombage et latte de bois empilé à l'état brut de 2,54 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.003	0.005	0.008	0.010	0.013	0.015	0.018	0.020	0.023	0.025
6	0.006	0.011	0.017	0.023	0.028	0.034	0.040	0.045	0.051	0.057
8	0.010	0.020	0.030	0.040	0.050	0.061	0.071	0.081	0.091	0.101
10	0.016	0.032	0.047	0.063	0.079	0.095	0.110	0.126	0.142	0.158
12	0.023	0.045	0.068	0.091	0.113	0.136	0.159	0.182	0.204	0.227
14	0.031	0.062	0.093	0.124	0.154	0.185	0.216	0.247	0.278	0.309
16	0.040	0.081	0.121	0.161	0.202	0.242	0.282	0.323	0.363	0.404
18	0.051	0.102	0.153	0.204	0.255	0.306	0.358	0.409	0.460	0.511
20	0.063	0.126	0.189	0.252	0.315	0.378	0.441	0.504	0.567	0.631
22	0.076	0.153	0.229	0.305	0.381	0.458	0.534	0.610	0.687	0.763
24	0.091	0.182	0.272	0.363	0.454	0.545	0.636	0.726	0.817	0.908
26	0.107	0.213	0.320	0.426	0.533	0.639	0.746	0.852	0.959	1.066
28	0.124	0.247	0.371	0.494	0.618	0.741	0.865	0.989	1.112	1.236
30	0.142	0.284	0.426	0.567	0.709	0.851	0.993	1.135	1.277	1.419
32	0.161	0.323	0.484	0.646	0.807	0.968	1.130	1.291	1.453	1.614
34	0.182	0.364	0.547	0.729	0.911	1.093	1.276	1.458	1.640	1.822
36	0.204	0.409	0.613	0.817	1.021	1.226	1.430	1.634	1.839	2.043
38	0.228	0.455	0.683	0.910	1.138	1.366	1.593	1.821	2.049	2.276
40	0.252	0.504	0.757	1.009	1.261	1.513	1.765	2.018	2.270	2.522
42	0.278	0.556	0.834	1.112	1.390	1.668	1.946	2.224	2.503	2.781
44	0.305	0.610	0.916	1.221	1.526	1.831	2.136	2.441	2.747	3.052
46	0.334	0.667	1.001	1.334	1.668	2.001	2.335	2.668	3.002	3.335
48	0.363	0.726	1.090	1.453	1.816	2.179	2.542	2.905	3.269	3.632
50	0.394	0.788	1.182	1.576	1.970	2.364	2.759	3.153	3.547	3.941
52	0.426	0.852	1.279	1.705	2.131	2.557	2.984	3.410	3.836	4.262
54	0.460	0.919	1.379	1.839	2.298	2.758	3.218	3.677	4.137	4.596
56	0.494	0.989	1.483	1.977	2.472	2.966	3.460	3.955	4.449	4.943
58	0.530	1.061	1.591	2.121	2.651	3.182	3.712	4.242	4.772	5.303
60	0.567	1.135	1.702	2.270	2.837	3.405	3.972	4.540	5.107	5.675

APPENDIX P

1.92 m ROUGH CEDAR STUDWOOD / BOIS DE COLOMBAGE DE CÈDRE À L'ÉTAT BRUT DE 1,92 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.92 \times 1.6841$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0,000\ 078\ 540)D^2 \times 1.92 \times 1,6841$

TABLE SHOWING CONTENTS OF STUDWOOD BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 1.92 m Rough Cedar Studwood) /
TABLEAU MONTRANT LE CONTENU DE BOIS DE COLOMBAGE DE CÈDRE À L'ÉTAT BRUT
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois de colombage de cèdre empilé à l'état brut de 1,92 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.004	0.008	0.012	0.016	0.020	0.024	0.028	0.033	0.037	0.041
6	0.009	0.018	0.027	0.037	0.046	0.055	0.064	0.073	0.082	0.091
8	0.016	0.033	0.049	0.065	0.081	0.098	0.114	0.130	0.146	0.163
10	0.025	0.051	0.076	0.102	0.127	0.152	0.178	0.203	0.229	0.254
12	0.037	0.073	0.110	0.146	0.183	0.219	0.256	0.293	0.329	0.366
14	0.050	0.100	0.149	0.199	0.249	0.299	0.348	0.398	0.448	0.498
16	0.065	0.130	0.195	0.260	0.325	0.390	0.455	0.520	0.585	0.650
18	0.082	0.165	0.247	0.329	0.411	0.494	0.576	0.658	0.741	0.823
20	0.102	0.203	0.305	0.406	0.508	0.609	0.711	0.813	0.914	1.016
22	0.123	0.246	0.369	0.492	0.615	0.737	0.860	0.983	1.106	1.229
24	0.146	0.293	0.439	0.585	0.731	0.878	1.024	1.170	1.317	1.463
26	0.172	0.343	0.515	0.687	0.858	1.030	1.202	1.373	1.545	1.717
28	0.199	0.398	0.597	0.796	0996	1.195	1.394	1.593	1.792	1.991
30	0.229	0.457	0.686	0.914	1.143	1.371	1.600	1.828	2.057	2.286
32	0.260	0.520	0.780	1.040	1.300	1.560	1.820	2.080	2.340	2.601
34	0.294	0.587	0.881	1.174	1.468	1.761	2.055	2.349	2.642	2.936
36	0.329	0.658	0.987	1.317	1.646	1.975	2.304	2.633	2.962	3.291
38	0.367	0.733	1.100	1.467	1.834	2.200	2.567	2.934	3.300	3.667
40	0.406	0.813	1.219	1.625	2.032	2.438	2.844	3.251	3.657	4.063
42	0.448	0.896	1.344	1.792	2.240	2.688	3.136	3.584	4.032	4.480
44	0.492	0.983	1.475	1.967	2.458	2.950	3.442	3.933	4.425	4.917
46	0.537	1.075	1.612	2.149	2.687	3.224	3.762	4.299	4.836	5.374
48	0.585	1.170	1.755	2.340	2.926	3.511	4.096	4.681	5.267	5.851
50	0.635	1.270	1.905	2.540	3.174	3.809	4.444	5.079	5.714	6.349
52	0.687	1.373	2.060	2.747	3.433	4.120	4.807	5.494	6.180	6.867
54	0.741	1.481	2.222	2.962	3.703	4.443	5.184	5.924	6.665	7.405
56	0.796	1.593	2.389	3.186	3.982	4.778	5.575	6.371	7.168	7.964
58	0.854	1.709	2.563	3.417	4.272	5.126	5.980	6.834	7.689	8.543
60	0.914	1.828	2.743	3.657	4.571	5.485	6.400	7.314	8.228	9.142

APPENDIX Q

2.60 m ROUGH SOFTWOOD VENEER / BOIS À PLAQUER RÉSINEUX À L'ÉTAT BRUT DE 2,60 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.30 \times 1.4588$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0{,}000\ 078\ 540)D^2 \times 1{,}30 \times 1{,}4588$

TABLE SHOWING CONTENTS OF VENEER BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 2.60 m Rough Softwood Veneer) /
TABLEAU MONTRANT LE CONTENU DES BILLOTS DE BOIS À PLAQUER
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois à plaquer de résineux empilé à l'état brut de 2,60 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.002	0.005	0.007	0.010	0.012	0.014	0.017	0.019	0.021	0.024
6	0.005	0.011	0.016	0.021	0.027	0.032	0.038	0.043	0.048	0.054
8	0.010	0.019	0.029	0.038	0.048	0.057	0.067	0.076	0.086	0.095
10	0.015	0.030	0.045	0.060	0.074	0.089	0.104	0.119	0.134	0.149
12	0.021	0.043	0.064	0.086	0.107	0.129	0.150	0.172	0.193	0.214
14	0.029	0.058	0.088	0.117	0.146	0.175	0.204	0.234	0.263	0.292
16	0.038	0.076	0.114	0.153	0.191	0.229	0.267	0.305	0.343	0.381
18	0.048	0.097	0.145	0.193	0.241	0.290	0.338	0.386	0.434	0.483
20	0.060	0.119	0.179	0.238	0.298	0.357	0.417	0.477	0.536	0.596
22	0.072	0.144	0.216	0.288	0.360	0.433	0.505	0.577	0.649	0.721
24	0.086	0.172	0.257	0.343	0.429	0.515	0.601	0.686	0.772	0.858
26	0.101	0.201	0.302	0.403	0.503	0.604	0.705	0.806	0.906	1.007
28	0.117	0.234	0.350	0.467	0.584	0.701	0.817	0.934	1.051	1.168
30	0.134	0.268	0.402	0.536	0.670	0.804	0.938	1.072	1.206	1.341
32	0.153	0.305	0.458	0.610	0.763	0.915	1.068	1.220	1.373	1.525
34	0.172	0.344	0.517	0.689	0.861	1.033	1.205	1.377	1.550	1.722
36	0.193	0.386	0.579	0.772	0.965	1.158	1.351	1.544	1.737	1.930
38	0.215	0.430	0.645	0.860	1.075	1.290	1.506	1.721	1.936	2.151
40	0.238	0.477	0.715	0.953	1.192	1.430	1.668	1.907	2.145	2.383
42	0.263	0.525	0.788	1.051	1.314	1.576	1.839	2.102	2.365	2.627
44	0.288	0.577	0.865	1.153	1.442	1.730	2.019	2.307	2.595	2.884
46	0.315	0.630	0.946	1.261	1.576	1.891	2.206	2.521	2.837	3.152
48	0.343	0.686	1.030	1.373	1.716	2.059	2.402	2.745	3.089	3.432
50	0.372	0.745	1.117	1.489	1.862	2.234	2.607	2.979	3.351	3.724
52	0.403	0.806	1.208	1.611	2.014	2.417	2.819	3.222	3.625	4.028
54	0.434	0.869	1.303	1.737	2.172	2.606	3.040	3.475	3.909	4.343
56	0.467	0.934	1.401	1.868	2.335	2.803	3.270	3.737	4.204	4.671
58	0.501	1.002	1.503	2.004	2.505	3.006	3.507	4.008	4.510	5.011
60	0.536	1.072	1.609	2.145	2.681	3.217	3.753	4.290	4.826	5.362

APPENDIX R

2.60 m ROUGH POPLAR VENEER / BOIS À PLAQUER DE PEUPLIER À L'ÉTAT BRUT DE 2,60 m

Formula: $m^3(st) = A \times L \times$ Rough Wood Factor
$= (0.000\ 078\ 540)D^2 \times 1.30 \times 1.4401$
Formule: $m^3(app) = A \times L \times$ Facteur de conversion du bois brut
$= (0,000\ 078\ 540)D^2 \times 1,30 \times 1,4401$

TABLE SHOWING CONTENTS OF VENEER BOLTS BY DIAMETER IN STACKED CUBIC METRES
(applicable to stacked 2.60 m Rough Poplar Veneer) /
TABLEAU MONTRANT LE CONTENU DES BILLOTS DE BOIS À PLAQUER
PAR DIAMÈTRE EN MÈTRES CUBES APPARENTS
(applicable au bois à plaquer de peuplier empilé à l'état brut de 2,60 m)

Diameter of Defect or Void/Diamètre du défaut ou de l'espace vide (cm)	NUMBER OF PIECES / NOMBRE DE PIÈCES									
	1	2	3	4	5	6	7	8	9	10
	CONTENTS IN STACKED CUBIC METRES / CONTENU EN MÈTRES CUBES APPARENTS									
4	0.002	0.005	0.007	0.009	0.012	0.014	0.016	0.019	0.021	0.024
6	0.005	0.011	0.016	0.021	0.027	0.032	0.037	0.042	0.048	0.053
8	0.009	0.019	0.028	0.038	0.048	0.056	0.066	0.075	0.085	0.094
10	0.015	0.029	0.044	0.059	0.074	0.088	0.103	0.118	0.132	0.147
12	0.021	0.042	0.064	0.085	0.107	0.127	0.148	0.169	0.191	0.212
14	0.029	0.058	0.086	0.115	0.146	0.173	0.202	0.231	0.259	0.288
16	0.038	0.075	0.113	0.151	0.191	0.226	0.263	0.301	0.339	0.376
18	0.048	0.095	0.143	0.191	0.241	0.286	0.333	0.381	0.429	0.476
20	0.059	0.118	0.176	0.235	0.298	0.353	0.412	0.471	0.529	0.588
22	0.071	0.142	0.214	0.285	0.360	0.427	0.498	0.569	0.640	0.712
24	0.085	0.169	0.254	0.339	0.429	0.508	0.593	0.678	0.762	0.847
26	0.099	0.199	0.298	0.398	0.503	0.596	0.696	0.795	0.895	0.994
28	0.115	0.231	0.346	0.461	0.584	0.692	0.807	0.922	1.037	1.153
30	0.132	0.265	0.397	0.529	0.670	0.794	0.926	1.059	1.191	1.323
32	0.151	0.301	0.452	0.602	0.763	0.903	1.054	1.205	1.355	1.506
34	0.170	0.340	0.510	0.680	0.861	1.020	1.190	1.360	1.530	1.700
36	0.191	0.381	0.572	0.762	0.965	1.143	1.334	1.524	1.715	1.906
38	0.212	0.425	0.637	0.849	1.075	1.274	1.486	1.699	1.911	2.123
40	0.235	0.471	0.706	0.941	1.192	1.412	1.647	1.882	2.117	2.353
42	0.259	0.519	0.778	1.037	1.314	1.556	1.816	2.075	2.334	2.594
44	0.285	0.569	0.854	1.139	1.442	1.708	1.993	2.277	2.562	2.847
46	0.311	0.622	0.933	1.245	1.576	1.867	2.178	2.489	2.800	3.111
48	0.339	0.678	1.016	1.355	1.716	2.033	2.371	2.710	3.049	3.388
50	0.368	0.735	1.103	1.470	1.862	2.206	2.573	2.941	3.308	3.676
52	0.398	0.795	1.193	1.590	2.014	2.386	2.783	3.181	3.578	3.976
54	0.429	0.858	1.286	1.715	2.172	2.573	3.001	3.430	3.859	4.288
56	0.461	0.922	1.383	1.844	2.335	2.767	3.228	3.689	4.150	4.611
58	0.495	0.989	1.484	1.979	2.505	2.968	3.462	3.957	4.452	4.946
60	0.529	1.059	1.588	2.117	2.681	3.176	3.705	4.235	4.764	5.293

APPENDIX S

SOFTWOOD BARK THICKNESS TABLE

Diameter cm	Bark Thickness (cm)	
	Single	Double
8	.2	.4
9	.2	.5
10	.3	.6
11	.3	.6
12	.3	.7
13	.3	.7
14	.4	.8
15	.4	.8
16	.4	.9
17	.5	.9
18	.5	1.0
19	.5	1.0
20	.5	1.1
21	.6	1.1
22	.6	1.2
23	.6	1.2
24	.6	1.3
25	.7	1.4
26	.7	1.4
27	.7	1.5
28	.8	1.5
29	.8	1.6
30	.8	1.6
31	.8	1.7
32	.9	1.7
33	.9	1.8
34	.9	1.8
35	.9	1.9
36	1.0	1.9
37	1.0	2.0
38	1.0	2.0
39	1.0	2.1
40	1.1	2.1
41	1.1	2.2
42	1.1	2.2
43	1.1	2.3
44	1.2	2.3
45	1.2	2.4
46	1.2	2.4
47	1.2	2.5
48	1.3	2.5
49	1.3	2.5
50	1.3	2.6

APPENDIX T

HARDWOOD AND POPLAR BARK THICKNESS TABLE

Diameter Cm	Bark Thickness (cm)	
	Single	Double
8	.2	.5
9	.3	.6
10	.3	.6
11	.3	.7
12	.4	.7
13	.4	.8
14	.4	.9
15	.5	.9
16	.5	1.0
17	.5	1.1
18	.6	1.1
19	.6	1.2
20	.6	1.2
21	.7	1.3
22	.7	1.4
23	.7	1.4
24	.7	1.5
25	.8	1.5
26	.8	1.6
27	.8	1.7
28	.9	1.7
29	.9	1.8
30	.9	1.9
31	1.0	1.9
32	1.0	2.0
33	1.0	2.0
34	1.1	2.1
35	1.1	2.2
36	1.1	2.2
37	1.1	2.3
38	1.2	2.4
39	1.2	2.4
40	1.2	2.5
41	1.3	2.5
42	1.3	2.6
43	1.3	2.7
44	1.4	2.7
45	1.4	2.8
46	1.4	2.8
47	1.5	2.9
48	1.5	3.0
49	1.5	3.0
50	1.5	3.1

APPENDIX U

RULE OF THUMB FOR DETERMINING THE BOARD FOOT CONTENT FOR LOGS

N.B. Log Scale

Diameter Small End (Inside Bark)	F.B.M.
5"	L – 2
6"	1¼ L
7"	2L – 1
8"	2½ L
9"	3L
10"	4L
11"	5L
12"	6L
13"	7L
14" 8' 9' to 17' 18' +	8L + 1 8L + 2 8L + 3